American Journal of Diseases of Children

VOL. 5 APRIL, 1913 No. 4

A STUDY OF MERORACHISCHISIS (SPINA BIFIDA OCCULTA)*

BARNET JOSEPH, M.D.
Assistant to the Chairs of Pathology and Anatomy
BURLINGTON, VT.

Merorachischisis is a partial defect in vertebrae in which there exists no hernial protrusion. Though this condition is also known as spina bifida occulta, the latter term is perhaps more applicable to the defect which is accompanied by a small or an invisible hernia. The deficiency may occur in any part of the bone and in any region of the spine. In the literature consulted, I find that it is most common in the lumbar region, less so in the sacral and least of all in the cervical. I have not been able to find an authentic case of it in the middle dorsal vertebrae. The statistics on spina bifida with tumor are, that it occurs once in a thousand births (one in eight hundred — J. D. Bryant). The frequency is probably greater for spina bifida occulta.

The influences which interfere with normal development of the vertebrae unquestionably operate at a very early stage of the formative period of the body. This may perhaps be better understood by a review of the processes that lead to the formation of a complete vertebra.

EMBRYOLOGY OF THE VERTEBRAE

At a certain stage of development, the human embryo is an irregular spherule, consisting of three layers—the germ layers. These are destined to be the forerunners of the fetal membrane and all the bodily structures. The outermost of these is termed the *ectoderm*, the innermost *entoderm* and the middle *mesoderm*. The mesoderm, besides giving origin to several other systems, is responsible for the genesis of the skeleton.

In what is to be the future dorsum of the embryo, the three layers are for a time so fused that a line of demarcation cannot be recognized (Fig. 1). Soon, however, the cells belonging to the entodermal layer of this region, begin to proliferate. The proliferation is the initial process

*From the Museums of Pathology and Anatomy of the College of Medicine, University of Vermont.

for a rapid formation of a cord of cells which become detached from the mother layer and come to lie independently in the fused mass of the three layers. This cord is situated longitudinally in the longitudinal axis of the embryo and is known as the *notochord*. The notochord is the scaffolding around which the vertebrae are built. The entoderm, after the detachment of the notochord, reunites.

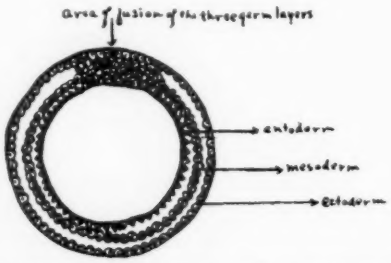


Fig. 1.—Diagrammatic representation of a cross section of a maturing ovum to show the point of fusion of the three germ layers.

While the notochord was being formed, a most important process took place in the ectoderm. The cells, lying in the corresponding longitudinal axis at first proliferated, forming the so-called "medullary plate." The medullary plate, next became furrowed. The furrow deepened toward the ventral surface of the future embryo and became a tube; the tube separated from the mother plate and thus has come into existence the primitive nerve tube — the medullary tube. After separation of the medullary tube, the ectoderm is reunited.

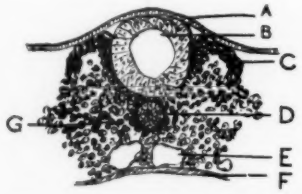


Fig. 2.—Diagrammatic representation of cross section through embryonal dorsum at about fourth week; A, ectoderm; B, medullary tube; C, muscle plate; D, notochord; E, primitive aorta; F, entoderm; G, mesenchymal cells of sclerotome.

The mesoderm is thus of course divided longitudinally, but it has meanwhile not been inactive. Its cells have multiplied, and at a certain stage we observe two solid columns of cells pressing at the sides of the medullary tube and notochord. They are the *mesenchymal cells*. The columns soon become divided by transverse fissures, into irregularly cuboidal blocks, the so-called "primitive segments." The transverse fissuring was followed almost immediately by longitudinal subdivisions of each segment. And thus instead of a single column of cells on either

side of the axial line, there is a series of irregularly subdivided cubes that run the length of the embryo. These cubes were at one time thought to be the primitive vertebrae (protovertebrae). We know now that only one of the subdivisions of the primitive segment — the sclerotome — is the forerunner of a vertebra.

As growth progresses, the mesenchymal cells forming the sclerotome, spread in all directions surrounding the notochord and medullary tube, passing between them and in front and behind (Fig. 2). The sheath thus formed is the *membranous vertebral column*. Also, the appearance of this sheath marks the disappearance of the outline of the primitive segment.

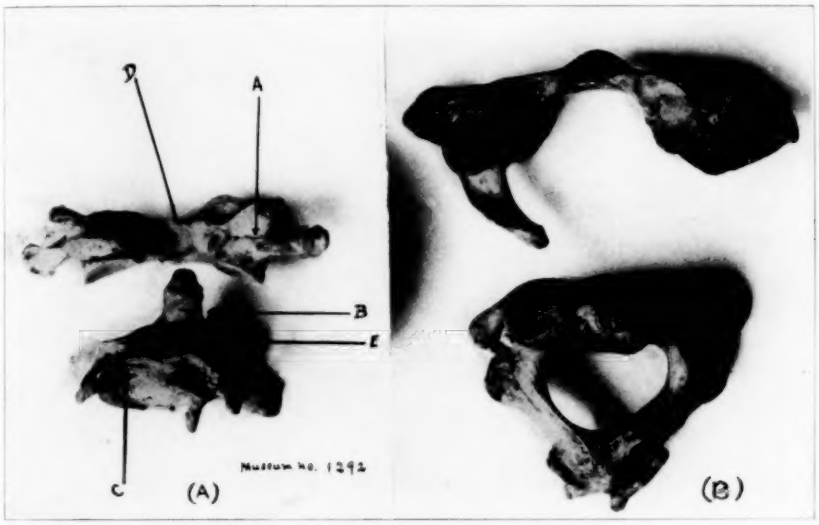


Fig. 3.—(A) Dorsal view of atlas and axis; A, B, C, knife cuts; D, articulating surface for odontoid process; E, rudimentary lamina for atlas. (B) View from above.

The next era is chondrification, but chondrification is preceded by a series of events in the sclerotogenous tissue that are absolutely essential for the development of a vertebra. In fact, these events blaze the path for the progress of cartilaginous deposition and we owe our conception of them and other phenomena, to Froriep's classical description.[1]

The first evidence of vertebral differentiation is a readjustment of the cells of the mesenchymal sheath to form alternate layers of condensated and rarified tissue. The condensation begins on either side of the notochord, at a point corresponding to about the center of a primi-

1. Froriep: Beitr. z. Anat. und Embryiol. Festgabe F. G. J. Henle, 1882, Table III; also His's Archives, 1883.

tive segment. By rapid extension, it proceeds to include the notochord and to pass in front of it, also backward and downward towards the medullary tube and posterior extremity of the embryo. It thus has the appearance of an arch—*the vertebral bow* of Froriep. That part of the bow which is in front of the notochord is known as the *hypochordal bow,* or brace. It is not chondrified except in the atlas.

The vertebral bow lies obliquely to a transverse section of the embryo, so that its convexity is a little above the center of a primitive segment, while its tips reach almost the lower border of the same.

From the rarified tissues between the vertebral bows are developed the intervertebral disks in front and the interlaminar ligaments behind.

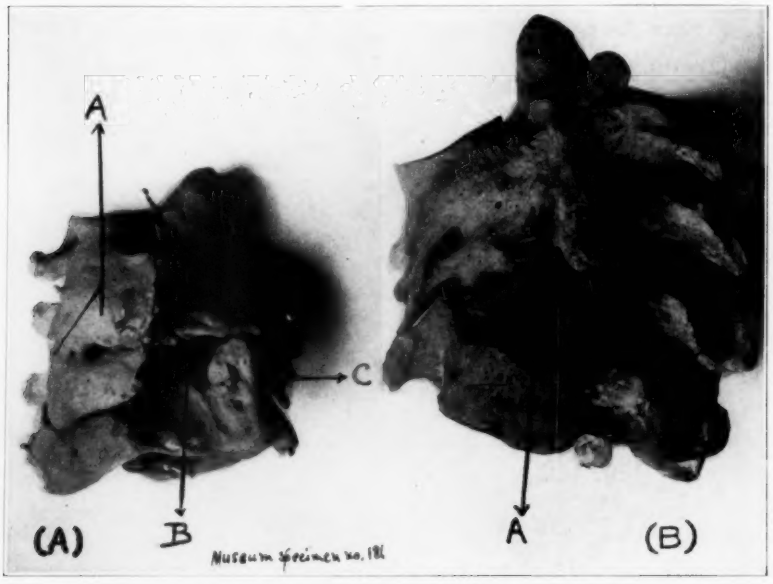


Fig. 4.—(A) Showing at A, agglutinated vertebral arches; B, defect in arches; C, common opening for two nerve trunks. (B) Ventral view to show also defect in body of fourth cervical vertebra.

The vertebral bow is still in process of organization when cartilage begins to be deposited within it. In man, the cartilagenous cells make their appearance at about the beginning of the second month.

In its downward and backward progress the vertebral bow meets with an obstruction. The obstruction takes the form of a wedge. Thence the tips of the vertebral bow become bifurcated. One division proceeds backward towards the medullary tube, so that with its fellow of the opposite side, it may form a ring (neural arch of the ossified vertebra) for protection of the future spinal cord, and the other is shunted outward and ultimately becomes the costal process and in the thoracic region, the anlage of a rib. The wedge is a *primitive muscle plate.*

A muscle plate is that subdivision of the primitive segment which gives rise to a number of muscle fibers (Fig. 2). Of course, it is only conjecture, but *it seems as if at this stage, conditions might arise which will bring about merogenetic deficiency.* For one thing, the formation of the vertebral bow is a bilateral process, and as in all bilateral processes of the forming body, one of the events may fail to appear. This seems to have been the case in at least one of our specimens (Fig. 3); one-half of the neural arch has evidently never made its appearance. Then again, the muscle plate of any particular region may have been missing or displaced. The muscle plates are to be looked on as guides to the vertebral

Fig. 5.—By permission from Surgery of Childhood (De Forrest Willard). Congenitally defective laminae simulating fracture of vertebral arch.

bows and any aberration of the former will throw the normal formation of a vertebra out of gear. In both Figures 3 and 4, there is self-evident proof of such events. (In Figure 4, the agglutination of the arches and bodies, and in Figure 3, the upward projection of a part of the neural arch of the axis.)

The process of chondrification is first manifest in the mesenchymal thickening around the notochord. In the second month, two cartilaginous nuclei appear immediately at either side of the notochord. Before long these become joined to another nucleus in front and to one behind. At the end of the second month, the notochord is strung with interrupted

irregular beads of cartilage. These masses of cartilage are the future vertebral bodies. The parts of the vertebral bow corresponding to the neural arches are still membranous. They begin to be chondrified at about the sixth week. It is a much slower process than chondrification of the bodies. At the end of the eighth week they fuse with and extend as short processes from the cartilaginous bodies.

Chondrification is not completed until the fourth month, and "up to this time," says Ziegler, "the dorsal covering of the medullary tube consists of the united portions of the membranous vertebral column." The method of completion of the neural arch is that of the two half arches gradually closing around the medullary tube. In the fourth month, they have so far fused dorsally as to form the spinous process of the vertebra.

Fig. 6.—Fifth lumbar vertebra.

DEFECTIVE DEVELOPMENT

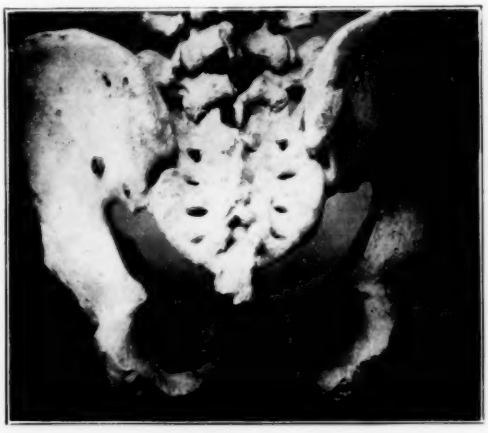
It would seem as if this were the stage when the cause effecting *spina bifida with protrusion was most apt to be generated.* Should the neural arches fail to coalesce while the spinal cord and membranes are progressively developing, it is but reasonable to expect that they will protrude from their incomplete confinement. Then, too, if the medullary groove had for some reason or other failed to become united, the neural arches cannot fuse posteriorly, with the result that when ossification sets in, it could go no further than the incomplete cartilages would allow.

In the fourth month a cartilaginous structure is present which is almost the perfect analogy of an osseus vertebra. But, as Minot[2] has already pointed out, ossification is merely a supplementary process and *produces no important change in the form or anatomical relations of the vertebrae.* A self-evident conclusion is thus manifest—the cause of

2. Minot: Human Embryology.

a congenital defect is created during the evolutionary period of the membranocartilaginous stage. In other words, the moment that differentiation of the sclerotonous cells begins, a pathologic factor may operate to produce any degree of defect. The pathologic factor may be inherent in the sclerotonous elements themselves, in the muscle plate, or the medullary tube. Seldom is a faulty ossification to be made responsible, for this process has no choice except to follow the path laid out for it by the membranocartilaginous events. A bony defect in general, may be looked on as a failure on part of the developing organism to supply the proper soil for bone growth.

The component parts of a vertebra are a body and an arch. The arch is joined to the back of the body, thus forming the neural canal.



7.—Defect is in first sacral segment. Note deficiency above and below this segment.

The arch itself is the result of a fusion, dorsally, of two symmetrical pieces. The prominence caused by the junction is the *vertebral spine*. The characteristics are common to all the vertebra, though in the different regions of the spinal column they are especially modified.

The spinal column is thus composed of individual segments. The segments are separated from each other by cushions. The whole are united by ligaments. The bodies of the vertebrae are for support and stature, the neural arches for protection of the spinal cord and nerve roots, and the transverse processes, hanging pegs for muscles. The spinal column has four curves—cervical and lumbar with their convexities forward; dorsal and sacral with their convexities backward. The curves do not exist in the infant and are not fully established until ossification is complete.

CONSEQUENCES OF DEFECTIVE DEVELOPMENT

It stands to reason that in a structure like this, a deficiency in any of the foregoing essentials will, besides being productive of a local trouble, bring about untoward pathologic states, the diagnosis of which may not always be clear. Nor is the original condition of merorachischisis easily recognized. De Forrest Willard[3] cites a case in fact, in which a child with marked distortion of the feet was operated on several times, before a bony defect of the lumbar vertebrae with a very slight protrusion was recognized. Indeed, talipes equino varus is not an uncommon complication of merorachischisis. E. Von Bergmann[4] says that sensory and trophic disturbances, frequently leading to extensive neuroparalytic ulcerations, may follow the faulty condition of the cord and be of differential value.

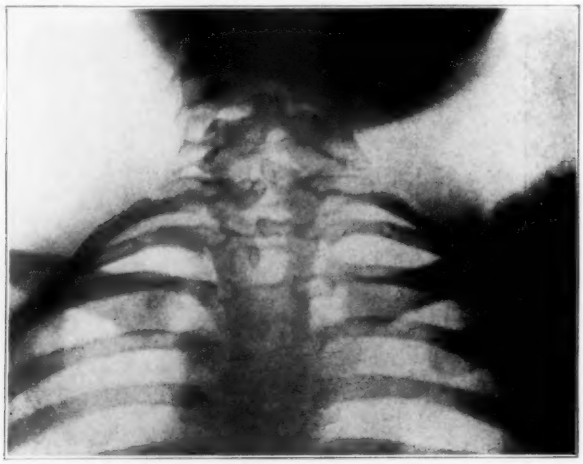


Fig. 8.—X-ray cervical merorachischisis. From the collection of Dr. J. W. Sever, Boston.

It is a well-proven adage that the *strength of a chain is the strength of its links*. This is especially applicable in case of the spinal column. Consequently we are rather to expect abnormal curvatures and deformities as a result of defects in any one vertebra. How futile would be the use of braces and jackets in such affections. That merorachischisis may be only part of an extensive local bone anomaly is evident from an examination of Figure 4. Here we see besides the deficiency in the laminae of the third and fourth cervical vertebra, fushion of the bodies of the second, third and fourth vertebrae, incomplete ossification of the body of the third, downward curvature of the right transverse processes

3. Willard, De Forrest: Surgery of Childhood, 1910.
4. Von Bergmann, E.: System of Practical Surgery, translated by W. T. Bull.

of all segments and a common intervertebral foramen for two nerve trunks. A case of this kind, successfully relieved by operative procedures, was reported by Jackson Clarke to the Clinical Society of London (November, 1906). His patient was a boy, 4 years of age, of apparently normal mentality, whose head was fixed from birth in such a position that the chin was close to the sternum and there was no movement in the cervical spine, either of flexion, extension or rotation. Besides partial defects, the *x*-ray showed extensive abnormalities in the form of the bones in the upper dorsal and cervical regions and a cervical rib on each side.

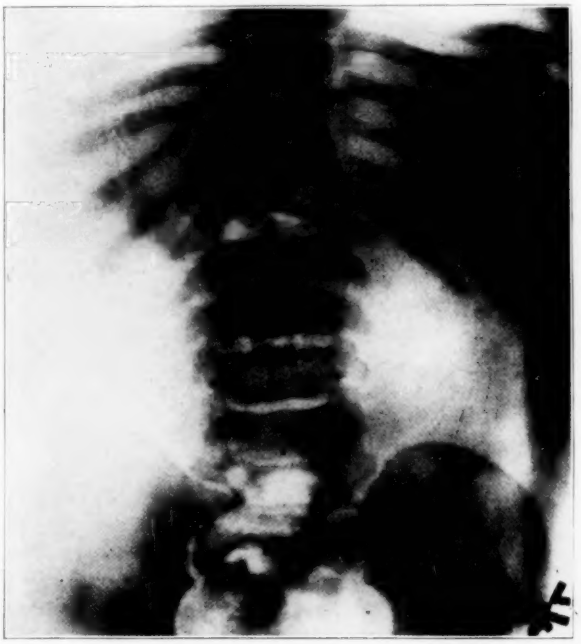


Fig. 9.—*X*-ray lumbosacral deficiency. From the collection of Dr. J. W. Sever, Boston.

Among the occult symptoms of merorachischisis, may be pressure manifestations of the cord. Keen[5] claims that these first develop during the period of greatest growth of the body, i. e., ninth to seventeenth year, and gives an excellent reason for the same. According to this author, firm fibrous bands are present which pass through the cleft and connect the skin over the cleft with the cord near its lower end. He believes that this represents an imperfect separation of the two during fetal life and does not grow with the growth of the structure it connects.

5. Keen: Surgery, ii, 828.

Hence it pulls and stretches the cord or presses it against the lower margin of the opening at the period when the body growth is at its maximum.

The development of neuropathic disturbances below the defect is always to be looked for.

Merorachischisis deprives the spinal cord of its proper bony protection, while the individuals so affected may not at all be aware of that deficiency until some trifling injury to the spine proves serious. Even a

Fig. 10.—Growth of hair at dorsolumbar region. Loaned by Dr. J. W. Sever, Boston.

most superficial consideration will demonstrate the import this state of affairs has beside a medicolegal bearing.

The specimen represented by Figure 3 was secured by Dr. B. H. Stone, Director of the Vermont State Laboratory of Hygiene, from a skeleton found in the woods of Wilder, Vt. There was a question of homicide and Drs. Stone and C. F. Dalton found on examination of the skull and first two cervical vertebrae, two criss-cross incisions in the bone, apparently made with a very sharp knife and inflicted with much force.

One of the slashes cut into the odontoid process of the axis. Acting on this evidence, the authorities apprehended the murderer, and it was proved beyond peradventure that he had inflicted the wound with a heavy square-topped razor. Apparently one of the cuts was fatal and it is Dr. Stone's belief that the upper spinal cord was severed by the square top of the razor, and he claims that such would be impossible in the event of normal bone. Dr. Stone is apparently the first to recognize the medicolegal aspect of such bone deficiency. De Forrest Willard[5] cites a case and presents a skiagram which should come in the category of forensic medicine. The skiagram (Fig. 5) was taken after a moderate lumbosacral injury and showed the condition indicated, without visible tumor. The question of fracture of the spinous processes, of course, came under consideration, but it was finally decided that a congenital defect existed and that the patient had narrowly escaped a spina bifida occulta.

Figures 6 and 7 represent specimens in our museum obtained from cadavers, the history of which we know very little, but which seemed apparently normal. It will be readily seen what the consequences of any moderate injury might have been. J. W. Sever, in a very interesting paper read before the American Orthopedic Association (June, 1909), exhibited two radiographs showing complex deficiency in the cervical and lumbar vertebrae (Figs. 8 and 9).

The clinical inference from a study of occult spinal deficiency is that we are dealing with a not very uncommon condition. A more careful examination of some obscure neuropathies would perhaps bring to light a greater number of instances of merorachischisis. A significant step was taken by Katzenstein,[6] who operated on and cured a case of persistent and obscure bladder symptoms of six years' standing. Peritz[7] makes this condition responsible for nocturnal enuresis, and is able to show radiographic tracings of an extensive fissure in the sacrum in one of his case series. H. B. Sheffield[8] reports a similar case of a boy of 7 with fissure of the sacrum. In this case there was almost constant incontinence of urine. The defect in the sacrum was discovered by accident when the child bent over. It was not visible in the erect state, but the deficiency in the bone was palpable.

All authors agree that the presence of a localized hypertrophy of the hair (hypertrichosis, Fig. 10) of the back is indicative of a deficiency of the vertebrae in the immediate vicinity. This did not obtain in the body from which Specimen 196 (Fig. 6) was taken. Masses containing tera-

6. Katzenstein: Centralbl. f. Chir., 1901.
7. Peritz: Dent. Med. Wchnschr., July 6, 1911.
8. Sheffield, H. B.: Med. Rec., New York, Feb. 3, 1912.

tomatous tissues not infrequently cover a defect in the neural arches. The tissues are derived from the germ layers. (De Forrest Willard.[3])

The masses may be composed of multiple cysts and grow progressively.[9] According to von Bergmann, lipoma, myoma, fibroma, angioma, dermoids and cholesteatomata are frequently found, evidence in all, of displacement of cell-nests either before or during the membrane-cartilaginous stage of the embryonal vertebral column.

---

9. Campbell, W. F.: Am. Jour. Surg., June, 1909.

PROTEIN MILK AS A CORRECTIVE OF DIGESTIVE DISTURBANCES *

HERBERT B. WILCOX, M.D. AND MINER C. HILL, M.D.
NEW YORK

WITH OBSERVATIONS ON THE PROTEIN METABOLISM OF INFANTS FED ON PROTEIN MILK, BY B. RAYMOND HOOBLER, A.M., M.D.

From the time of its first introduction by Finkelstein and Meyer, protein milk has been the subject of much experimental use and many reports have appeared by those employing it as an infant food, a substitute for ordinary milk formulas.

The experience of these various writers has differed largely in their methods of preparation which have given widely divergent fat percentages and caloric values to the mixture, and for this reason it may be well stated at the outset that our experience has to do with a protein milk made from skimmed milk and having a fat content of less than 1 per cent.

There has been less variety in the application of the preparation, all of its users having advocated or condemned it on the basis of its value as a means of nourishment, an article of diet.

In the summer and winter of 1910-11 protein milk was, under Dr. John Howland, used as the routine and continued diet for nearly all patients in the infant's wards of Bellevue Hospital. On it digestive irregularities cleared up more rapidly than with any other method of treatment. Although in a large majority of cases the stools became rapidly normal and all evidences of indigestion disappeared, still the children failed to gain in weight or suffered continued loss.

The incentive for the undertaking of the study on which this report is based lies in the conclusion, then reached, that the value of protein milk depends on its use as a corrective; that it is not to be considered as a fit means of prolonged nourishment, and that its period of usefulness is limited to the first seven to ten days of the dietetic treatment.

In any acute digestive disturbance low fats and sugars are certainly indicated, while higher proteins than we have until recently believed advisable are now known to be well borne, and indeed actively beneficial. To the early stages of such digestive trouble protein milk seems to us to

---

*From the children's wards of the First Medical Division of Bellevue Hospital.

*Read before the Pediatric Section New York Academy of Medicine, December, 1912.

be better adapted than any other food preparation, but as the severity of the disturbance lessens, the tolerance for and need of more fats and carbohydrates increases and the high protein, while still well borne, is less needed as a neutralizer of fatty and carbohydrate fermentation. Its prolonged continuance must bring about a needlessly heavy drain on the nitrogen metabolism.

During the first eight months when protein milk was made use of as a substitute for other milk mixtures, about 400 infants varying from prematurity to 12 months of age were given the mixture, in most instances during their entire stay in the hospital ward—a period averaging one month.

The results were most gratifying in that these children quickly recovered from the acute evidences of their digestive abnormality, but we were usually unsuccessful in our attempts to make them gain in weight. This fact, coupled with the evidence which we had that cases of gastric indigestion, colitis, non-infectious diarrheas and simple digestive incapacities responded with unexpected promptness, led us to begin the use of protein milk as an initial corrective alone.

We have deviated in the preparation from the principles as first laid down by Finkelstein and Meyer only in the lower fat in our mixture. While believing, as did they, that no one food element can be considered alone as the cause of digestive disturbances but must be considered with due regard for its interaction with the other elements, we are certain that the need of low fats is of first importance in treatment.

In the application of the food we have followed a plan quite different from that of the originators or of any others with whose work we are familiar. We have found no need of preceding protein milk by tea or cereal decoctions. This preliminary took Finkelstein and Meyer three days and involved great initial loss in weight. No objection has become apparent to the use of protein milk in combination with other foods. We have combined it with benefit with plain milk mixtures, breast milk and some solid foods. We believe that the continuance of protein milk over many weeks unnecessary and oftentimes injurious.

Finkelstein and Meyer in 123 patients obtained good results, but gain in weight only with relatively high carbohydrates and by feeding very large amounts of the food. Finkelstein and Meyer, Birk and several others experienced great difficulty in getting their cases changed from protein milk to other foods, and advised strongly against its combination with any of them.

Abt advocated the early addition of sugar to albumin milk but believed in its use for two months or over.

The intent of this paper is to show:

1. Protein milk is best given without preliminary course of tea or cereal decoctions.

2. It is efficacious in all acute and chronic infections of the gastro-intestinal tract.

3. It is equally suited to fermentative and putrefactive processes.

4. It is better given in combination with other foods than alone, except for a short initial period.

5. Children placed on it can, without danger, be quickly swung over to plain milk mixtures.

From May, 1911, to November, 1912, 261 children suffering from a variety of digestive disturbances were given protein milk. A large majority of them remained in the ward over three weeks, or long enough to enable us to come to some definite conclusions as to the results. They varied from prematurity to 9 years of age. Before instituting protein milk diet, in many instances plain milk mixtures were tried for comparison.

These cases were divided, not as has been usual, into those particular groups spoken of as dyspepsias, decompositions, intoxications and atrophies, but, because they seemed to describe our material better, into three broader clinical groups:

1. Acute infections of the gastro-intestinal tract evidenced by vomiting, bad stools and fever.

2. Apparently non-infectious indigestions due to previous nutritional abuse.

3. Simple diarrheas. By this we mean those infants who cannot be given a food strong enough to increase body weight without accompanying gastric or intestinal over-activity.

In general it may be said, in regard to age, that protein milk is better suited to children over than under 3 months of age.

Of 256 children, 72 were 3 months or less, of whom 56 per cent. did well; 97 were from 4 to 7 months, of whom 76 per cent. did well; 62 were from 8 to 12 months, of whom 85 per cent. did well; 25 were over 1 year, of whom 72 per cent. did well.

Among these were many suffering from very severe digestive abnormalities, and in forty-four cases an unsuccessful trial of diets other than protein milk was first made. The number of cures in the children over 3 months was 21 per cent. greater than that of the very young.

The improvement resulting in the use of protein milk in acute intestinal infections evidenced by fever and frequent bloody mucous stools, is more striking than in any other condition. Two series of such cases were observed side by side.

ILLUSTRATIVE CASES

Of twenty-two cases of severe acute intestinal infection, 77 per cent. were cured while on a diet of protein milk. There were forty-four cases of severe intestinal infections of longer duration which we failed to correct by plain milk modifications. Of these 70 per cent. were cured when changed to protein milk. With the initial use of protein milk, of 198 intestinal cases, many of which were severe, 73 per cent. of cures were effected. There occurred sixty-one children suffering from chronic non-infectious digestive disturbances with whom plain milk formulas had failed; 62 per cent. were discharged with normal digestions following a course of protein milk treatment.

CASE 1.—M. L. Acute infectious diarrhea. Aged 9 months; weight 10 pounds 13 ounces. Admitted with a history of fever, diarrhea, vomiting and convulsions for two days previous.

Treatment: No cathartic or starvation period. High colon irrigations of salt solution were given twice a day. Placed immediately on protein milk, five feedings of 7 ounces, in twenty-four hours. Calories, 60 per kilo. There was no vomiting after admission to hospital. At first the stools were loose, green, with quantities of mucus and blood. On the third day there were two stools described as yellow, pasty. On the fourth day one-half ounce of malt was added, increasing the calories to 67 per kilo. The child was kept on this feeding for five days. The digestion remained good; there was no vomiting; she gained 6 ounces.

The formula was then changed to a whole-milk mixture, fat 1.6, sugar 6.8, proteid 1.4. Calories 98 per kilo. For the following four days, the digestion remained good, and the child gained 4 ounces. Discharged cured.

As a means of controlling vomiting protein milk has also proved of value. Vomiting due to too large, irregular or too frequent feeding without actual gastric indigestion will, of course, respond as quickly to a proper régime on plain mixtures as on protein milk. The vomiting of true gastric indigestion, however, was frequently relieved by protein milk when other means had produced no improvement.

Among our cases there were very few having gastric symptoms unassociated with evidences of intestinal derangement. In 74 instances, however, vomiting was the predominating symptom; 30 of these were put at once on plain milk modifications and 80 per cent. did well. The 20 per cent. failing to respond to this diet promptly recovered when given protein milk. The remaining 44 children were put at once on protein milk with good results in 82 per cent. Moreover, it should be recorded that in nearly one-half of the 18 per cent. of failures the patients were suffering from and ultimately died of parenteral affections.

CASE 2.—A. R. Gastric indigestion. Age 3 months; weight 7 pounds 13 ounces. Admitted for vomiting. She had been breast fed two months and then was put on a formula of whole milk 6 ounces, barley-water 13 ounces, lime-water 1 ounce, milk-sugar ½ ounce. Feeding 3½ ounces every 2½ hours. For five days before admission she was cross and fretful and vomited part of every feeding.

Treatment: No cathartic or starvation period. She was placed immediately on protein milk, seven feedings of 3½ ounces in twenty-four hours, calories 55 per kilo. Feedings were taken reluctantly at first, but vomiting stopped immediately. The stools, two to three a day, were normal. The child was kept on protein milk five days, during which period she lost ½ ounce. The formula was then changed to a whole milk mixture: Fat 1.4, sugar 3.5, protein 1.2. Calories 61 per kilo. There was no vomiting, the digestion was good and she gained 1½ ounces in three days. Dextrimalt was increased to 1 ounce, raising the calories to 77 per kilo. There was no vomiting, the digestion was good and she gained 2 ounces in three days.

Children are frequently seen who have a food tolerance sufficient to allow their being given only enough food without accompanying digestive upset to hold them in stationary weight, every addition to their diet resulting in evidence of gastric or intestinal overstrain. In a group of such cases we failed to find a mixture which could be given in sufficient quantities to insure gain in weight. Then protein milk was given for a period of from four to ten days, after which time it was possible to give without evidence of indigestion and with gain in weight, as additions to the diet, the very formulas which had previously failed. This increase in food tolerance, apparently brought about by protein milk, applies equally to fat, carbohydrate and protein.

Seventeen children were admitted with histories of no definite indigestion but with a record of little or no gain in weight. On weak mixtures the stools were good. On stronger mixtures the stools either became bad, or were unaffected, but no children gained in weight. They were given protein milk and with gradual additions, as is later to be described, all were discharged on plain milk mixtures, consistently gaining in weight.

Case 3.—G. C. Permanent Increase in Digestive Capacity. Age 8 months. Admitted for loss of weight, weighing 10 pounds 4 ounces. There was no cathartic or starvation period. He was given a formula of whole milk 9 in 20; 8 ounces; five feedings, 129 calories per kilo. The feedings were well taken but stools were three a day, loose, green, with mucus and curds. There was a loss of 4½ ounces during this period. He was then placed on protein milk, 8 ounces, five feedings, calories 72 per kilo, for six days. The feedings were taken well and the stools became yellow and well formed. He lost 8 ounces in four days. Malt, ½ ounce to the total food, was then added; calories 88 per kilo. He was for three days on this formula, the stools remaining good and the child gaining 4 ounces. Then three feedings, 8 ounces each, of whole milk 8 in 20 with ½ ounce milk-sugar, were introduced, the caloric value being 135 per kilo. On protein milk and whole milk for seven days, the digestion remained good, without gain or loss of weight. All feedings were then made of whole milk 10 in 20 with 1 ounce of malt having a caloric value of 123 per kilo. The digestion remained good and in seventeen days the child gained 27 ounces.

The indication for protein milk seems equally clear whether the indigestion be dependent primarily on a fat or carbohydrate incapacity; a bacterial fermentation or putrefaction. Whether it be fat or sugar primarily at fault, it is usual that an incapacity for both soon obtains.

The low fat and sugar of protein meet this need. If fermentation predominate, the low fats and sugars tend to retard it and the high protein, whether chemically or mechanically, seems to be active in neutralizing this fermentation, in aiding the digestion of the other food elements and in restoring the balance of the intestinal flora. If putrefaction exists, protein milk furnishes enough sugar to inhibit the pure proteolytic activities of the bacteria by turning the facultative organisms to fermentative activity.

Friedlander and Greenbaum have shown that protein milk tends to reduce the number of gas bacilli in the stools and to substitute acidophilic for putrefactive organisms if the latter predominate.

Protein milk is not a general panacea. Nor do we consider it the only means of controlling digestive abnormalities. The majority of these problems are amenable to usual methods of diet regulation aimed at the particular need of the case in hand. It has, however, been our experience that those indigestions which do not respond to such usual means will respond much more readily to this treatment than to the less rational procedures of initial starvation, rough purgation, sugar infusions and other usual or unusual methods. Three years ago every child on admission was given castor oil. Before protein milk was used this standing order was modified and only the more severe intestinal cases received this vigorous initiation. Since protein milk has been in use we have stopped castor oil altogether and are satisfied that bad stools give place to good ones as quickly and with less drain on the intestinal tract than when such rough purgation was employed.

While it is admittedly a part of the intelligent appreciation of any intestinal problem that we should know the type of infecting organism, there is reason to believe that diarrheas due to the gas bacillus, the dysentery bacillus or any other bacterium may be logically treated and more easily and rapidly corrected by protein milk than by purely bacterial starvation methods. Reason for such belief is found in the fact that these inhabitants of the intestinal tract are more or less facultative in their biochemical activities, and anything like a pure culture of any one group is a rare intestinal finding.

Among forty-four children suffering from a variety of digestive troubles which had resisted other treatment for some time, thirty were cured with gain in weight, eight were cured with stationary weight, and six did not improve and died of malnutrition, when given protein milk.

CASE 4.—C. K. Intestinal Indigestion. Age 9 months; weight 9 pounds, 11 ounces. Admitted with a history of losing weight, and frequent loose stools for an indefinite period. No cathartic or starvation period was employed. She was placed on a formula of whole milk with dextrimaltose, containing fat 1.6 per cent., sugar 3.2 per cent., protein 1.2 per cent. Six feedings of 7 ounces were given; calories 85 per kilo. She was eight days on this feeding, took it well, with

no vomiting, but there was loss of weight (16 ounces) and no improvement in stools, which averaged five a day and were loose, greenish-yellow, with curds and a little mucus.

The diet was then changed to protein milk six feedings of 8 ounces; calories 99 per kilo. In three days the child was having two yellow, pasty stools in twenty-four hours, but lost 3 ounces. Three feedings of a skimmed milk formula, fat 1.0 per cent., sugar 2.25 per cent., protein 1.75 per cent., were given alternately with the protein milk; calories 97 per kilo. In three days she gained 5 ounces, her digestion remaining good.

The child was then given all feedings of a whole milk mixture with milk sugar. Fat 1.8, sugar 4.8, protein 1.2; calories 95 per kilo. During the following five days there was no vomiting, an average of two yellow pasty stools a day and a gain of 9 ounces.

CASE 5.—Y. G. Fermentative Diarrhea. Age 8 months; weight 8 pounds 7 ounces. He was bottle fed since two weeks old. One week before admission he began to have diarrhea and occasional vomiting, and was always hungry. During the past day or two there had been fifteen to twenty loose, green, watery stools a day, acid, frothy, with large amount of gas.

There was no cathartic used or starvation period. He was given protein milk, five feedings of 6 ounces; calories 70 per kilo, during a corrective period of five days, and lost 3 ounces. On the fifth day the stools were three in number, "yellow, pasty." The child was then placed on a whole milk mixture with dextrimaltose (fat 2.4, sugar 5.00, protein 2.00); calories 140 per kilo. For the next five days the digestion remained good, with two to three yellow, pasty stools a day. Gained 5 ounces. Discharged cured.

PREPARATION OF PROTEIN MILK

Buttermilk: Our buttermilk is made from a pasteurized skim milk containing 1.75 per cent. fat. To one quart of this is added 1 ounce of buttermilk from some reliable dairy. This is allowed to stand for twelve hours at a temperature of 70 to 80 F., is thoroughly beaten at intervals of two to three hours and then placed on ice till used.

Each day's buttermilk is made from that of the preceding day, a smaller amount of stock being needed as time goes on. The amount of such stock used is determined by the degree of acidity desired.

Junket: To 2 quarts of pasteurized skim milk two Hansen junket tablets are added. After standing twenty minutes at 100 F., the precipitated casein is strained through gauze, washed in water, and forced several times through a fine sieve with a potato masher. This process of sieving is facilitated by adding buttermilk to the curd, and is continued until the curd has been thoroughly broken into fine flakes. One quart buttermilk, 1 quart water and 1 grain of saccharin to the quart are added to the curd and the whole thoroughly beaten to form a fine suspension.

The only difficulty in the preparation lies in obtaining a fine, flocculent suspension of the curd, which depends chiefly on thorough sieving. Boiling the precipitated casein is of no benefit.

Composition: Protein milk thus made consists of fat 0.8 per cent., sugar 2.4 per cent., protein 2.8 per cent. The caloric value is 8.5 to the ounce.

ADMINISTRATION

Children take this milk readily. It must not be heated too quickly nor above 90 F., otherwise tough masses of casein are likely to form. A large hole in the nipple is necessary and the feeding should be interrupted and the bottle thoroughly shaken every one to two minutes in order to keep the casein from settling to the dependent part of the bottle while the fluid portion alone is being consumed.

DURATION OF ADMINISTRATION

The length of time that protein milk should be continued depends primarily on the digestive condition and secondarily on this factor *plus* the gain or loss in weight. If, at the end of two to three days on protein milk alone there is improvement in the number or character of the stools, with even slight gain in weight, no addition is made to the diet until the stools assume the appearance characteristic of a pure protein milk diet. This will come about usually in four to five days and the stools then are quite regularly one to two daily, very large, light yellow, of the consistency of putty, rather dry, without odor, and are free from any unmixed particles or mucus. If, on the other hand, in the first few days there is loss of weight—and this is more frequently met with than gain—on the first appearance of betterment in the digestive condition, additions to the protein milk are begun.

The corrective period naturally divides itself into four stages:

1. That in which protein milk alone is given.
2. That in which protein milk plus malt sugar is given.
3. That in which much protein milk plus a small amount of plain milk is given.
4. That in which the protein milk is largely replaced by plain milk.

The usual duration of the first stage was three days, varying from two to fourteen. As soon as the digestive condition showed some improvement the first step toward increasing the food value was made by the addition of malt sugar. A proprietary malt soup was first used and was satisfactory, except for its laxative qualities, limiting the amount that could be used, an occasional resultant gastric irritability, and its expense. Another malt, to each ounce of which was added 3.5 grains of potassium carbonate, to bring its alkalinity up to that of the first-mentioned malt, was next used and found to be equally good. Better than either the foregoing, however, we found dextrimaltose, first used at Bellevue by Dr. L. E. La Fétra, from whose service this report is made, which may be used in greater quantities with less danger of gastric or

intestinal irritability. This is to be added in small quantity to the day's food-supply, beginning with 1 teaspoon and increasing to from 1½ to 2 ounces. The first two of the malts mentioned may be used practically alike, each having a caloric value of about 70 per ounce by volume, while the dextrimalt has 110 to 120 calories per ounce by weight.

CASE 6.—E. B. Protein Milk with Malt. Age 5 months, weight 6 pounds 9 ounces. Admitted to Bellevue Hospital Sept. 20, 1910, for loss of weight, diarrhea and vomiting. The child had been fed on half strength whole milk at home.

Treatment: No cathartic or starvation period. He was given protein milk, six feedings of 5 ounces for five days, representing 82 calories per kilo. The digestion was good, but there was a loss of 5 ounces. One-half ounce of Freihofer malt was added, increasing the calories to 104 per kilo. He gained 12 ounces in the following twenty-eight days, and was then given alternate feedings of a whole milk mixture, 8 ounces in 20, and protein milk with ½ ounce of malt. Calories 116. The digestion remained good but he gained only 2 ounces in twelve days. The child was discharged to mother's care and cure followed in dispensary. The digestion remained good and the child gained steadily.

The average duration of the second part of the corrective stage was six days, varying from two to twenty-three days. When the digestive condition warranted it, one feeding of a skim-milk, lime-water, milk-sugar and barley formula was made to replace a protein milk feeding, and increased until the daily diet consisted of half skim-milk and half protein milk. This was done either after the maximum amount of malt had been added or while it was still being increased, according to the evident ability of the child to accept more and stronger food. At this point whole milk mixtures were substituted gradually for skimmed-milk and such changes continued until the child was taking a formula suited to the age and weight. The aim was to make the first period, that in which protein milk alone was given, as short as possible. One cause of failure in the use of protein milk, as stated by Finkelstein and Meyer, was inanition in the early stages of treatment. To avoid this difficulty, malt and one or more milk feedings were given early. These could be given earlier and increased more rapidly when in combination with protein milk than was possible without its aid. It was also found that much better results were gotten from the addition of malt and some plain milk than by providing all the calories needed with malt alone and thus raising the carbohydrate percentage higher than is safe or desirable. The time necessary for the entire correction period averaged twelve days, when the child was discharged and turned over to dispensary direction.

CALORIES AND WEIGHTS

With the bulk of the food consisting of protein milk the calories received during these corrective stages were low and pronounced gain in weight was not expected. Such was the apparent influence of the protein milk on the assimilation of the other food added, however, that

gains were noted in many cases where none was looked for. It is not to be expected that young children will gain in weight when taking less than 30 calories per kilo on the usual milk diets, yet, as will be seen, many of our cases did so. In the later stages when protein milk had been replaced by plain milk, it occasionally happened that children previously gaining and digesting well, lost weight, and had bad stools. These untoward conditions disappeared again on the replacing of the protein milk feedings. This furnishes a striking illustration of the stabilizing effect of a certain amount of protein milk in the daily diet.

First Corrective Period.—While on protein milk alone 105 children received 50 or less calories per kilo; 100 received from 50 to 75 calories per kilo and 32 received from 75 to 100 calories per kilo.

During this stage 118 gained weight or were stationary; 29 lost. Gain in weight was not expected while protein milk alone was given. Stationary weight or moderate initial loss was the rule, and was naturally so in consideration of the low calories taken. The striking fact is that 80 per cent. of the children got through this first period without loss of weight, and, in less than a week, with digestion much improved, were ready to assimilate a stronger food.

Second Corrective Period.—While on protein milk and malt 18 babies received less than 50 calories per kilo, 54 received from 50 to 75 calories per kilo, and 47 received from 75 to 100 calories per kilo. That is, at the end of six days an increase of 33 per cent. in the food given was possible without any signs of indigestion.

During this second stage of the corrective period, of 119 cases, 94 gained in weight, or were stationary and 25 lost weight. That is, at this stage of their treatment more than half the children previously stationary in weight and suffering from badly deranged digestions were taking a food closely approximating their needs and doing well. From this point on the increase to skim- and later whole-milk mixtures was made rapidly so that at end of the second week of treatment the protein milk had been stopped and the children were doing well on plain milk mixtures.

In no case was any untoward result noticed from combining protein milk and plain milk feedings.

PROTEIN MILK IN COMBINATION WITH OTHER FOODS

Protein milk was used with benefit in combination with cane-, milk- and malt-sugar, plain milk and breast milk.

Malt is in most cases best, but certain children do not bear it so well as cane,- or milk-sugar alone, or one of these in combination with smaller amounts of malt. As before stated, protein milk, with all sorts of milk formulas, was used successfully, and as soon as possible to avoid loss in weight.

In twelve infants suffering from very severe nutritional disorders, after resorting to breast milk without improvement, protein milk alternating with breast milk feedings was tried. In all of these patients the stabilizing effect of the protein milk was immediately apparent and the breast milk previously poorly borne was well assimilated.

CASE 7.—E. F., aged 2½ months, weight 6 pounds 3 ounces, was admitted for vomiting, diarrhea and failure to gain weight. She was the child of a 13-year-old girl, had had poor care and improper feeding since birth, and was in very poor condition. After a trial of five days on weak milk mixtures with no improvement and with loss of weight, she was put on protein milk. In two days the stools were improved and she had gained 2 ounces. With the addition of some plain milk thin, watery stools again appeared. Alternating feedings of protein milk and breast milk were given with improvement in the stools but no gain. Because of this lack of gain, breast milk alone was given but there was prompt evidence of indigestion and loss of weight.

On protein milk alone this child had good stools but lost weight. With any other food alone she both lost weight and had signs of indigestion. Hoping to benefit from the stabilizing effect of protein milk on a diet of this preparation and breast milk, she was put on five feedings of breast milk and two of protein. The digestion remained good and there was a steady gain of ½ ounce a day for thirty days. At the end of this time she was put on a whole milk mixture and did well.

SUMMARY

1. Protein milk is essentially a therapeutic agent. It is not suitable for use as a continued diet.

2. It is suitable for use at all ages, but better adapted to children over 3 months.

3. It is indicated in gastric or intestinal indigestions, acute infections or chronic incapacities, fermentations or putrefactions.

4. It is of the greatest therapeutic efficiency when made from skim-milk.

5. It is best used without preliminary starvation or purgation.

6. It may be used in combination with any plain milk mixture.

7. Children may be abruptly changed from it to plain milk formulas without danger.

8. It should be partially withdrawn with the first signs of digestive improvement.

9. It should be replaced by suitable milk formulas as fast as the patient's tolerance will admit.

10. Fresh milk and breast milk, when taken badly alone, are often well borne if combined with protein milk.

11. Caloric values of the food may be more rapidly increased when some protein milk is given.

12. Protein milk is especially indicated in acute intestinal infections.

159 East Seventieth Street.

PROTEIN METABOLISM IN INFANTS FED ON PROTEIN MILK

B. RAYMOND HOOBLER, A.M., M.D.
NEW YORK

The original experiments detailed in this paper were undertaken for the purpose of determining whether a child fed on relatively high protein food was able to absorb large quantities of nitrogen and to what extent it retained and utilized such food element in building up its tissues.

From among the large number of infants in Bellevue Hospital who were fed on protein milk one was chosen as being a typical case for which protein milk was indicated. This child was brought to the hospital because of diarrhea and loss of weight. He was 7 months old and weighed 12 pounds on admission. Previous to admission he had been having from eight to ten watery stools daily and was rapidly losing weight. Four days previous to the beginning of the metabolism experiment he was fed on protein milk, which contained protein 2.8 per cent., carbohydrate 2.4 per cent., fat .8 per cent. After having been four days on this diet he was put on a metabolism bed and the diet of protein milk continued for the ensuing three days, during which time the urine and feces were accurately collected. At the beginning of the experiment the stools had changed from the green, watery stools on admission to the smooth, pasty, grayish-yellow type.

The data obtained from an analysis of the nitrogen content of the food, urine and feces is summarized in the first three lines of Table 1, which represent the three consecutive days on a metabolism frame. The fourth line represents the nitrogen metabolism in a normal child fed on approximately the same quantity of nitrogenous food and of the same age. The fifth and sixth lines show the nitrogen metabolism in a child of 8 months, and the seventh line a child of 7½ months, reported by Drs. Holt and Levene.[1] These last two children were both fed on a high protein diet.

The nitrogen requirement for a normal infant at 7 months artificially fed is about three grams of nitrogen daily. It will be seen that the infant placed on the metabolism frame received a little over five grams daily, hence was receiving more than its necessary quota of nitrogen. This would be true were we to compare this undersized, ill-nourished child with the normal, but when we consider that the child had been losing weight and that the muscle tissue shared in the loss, it would seem that there must have been a depletion of the nitrogen content of the body. It was justifiable, therefore, to give the infant sufficient nitrogen in the

1. Holt, L. E., and Levene, P. A.: AM. JOUR. DIS. CHILD., November, 1912.

food to make up for any loss that may have taken place, since it has been demonstrated that the tissue cells will absorb large quantities of protein when the protein-supply of such cells has been previously entirely cut off or greatly diminished.

Nitrogen was absorbed in the characteristic manner. It has been shown many times that sick babies as readily absorb protein as do well babies, regardless of whether there is a small or large quantity ingested; the per cent. of the intake which is absorbed is usually above 90 per cent. The amount of the nitrogen lost through the feces in protein feeding is not greater than that of either breast- or bottle-fed normal babies. The amount of nitrogen lost through the urine varies greatly, and with those artificially fed varies with the amount of protein ingested. It is not surprising, therefore, to find in this series that the urinary nitrogen was

TABLE 1.—STUDIES IN NITROGEN METABOLISM IN NORMAL AND ABNORMAL CHILDREN

Line No.	Name	Age in Mos.	Food Formula			Total Nitrogen			Nitrogen Absorbed in Grams in 24 Hrs.		Nitrogen Retained in Grams in 24 Hrs.	
			Prot. %	Fat %	Carbo. %	Food	Urine	Feces	Abs. am't	Per cent. Intake	Abs. am't	Per cent. Intake
1	J. G.	7	2.8	.8	2.4	5.37	3.65	.239	5.13	95.5	1.48	27.6
2	J. G.	7	2.8	.8	2.4	5.37	3.42	.332	5.04	93.8	1.62	30.1
3	J. G.	7	2.8	.8	2.4	5.37	3.10	.369	5.00	93.1	1.90	35.4
4	Rubner and Heubner normal case	7½	2.7	3.2	5.0	4.39	3.06	.281	4.11	93.5	1.06	24.1
5	Holt and Levene F. H. Period 4..	8	3.0	1.6	4.7	5.57	4.29	.587	4.98	87.7	.700	12.6
6	Holt and Levene F. H. Period 5..	8	2.9	1.9	2.3	5.71	4.78	.340	5.37	94.0	.590	10.4
7	Holt and Levene J. S.	7½	3.5	1.4	5.0	5.39	2.83	.672	4.72	87.6	1.89	35.0

much above that excreted by the average normal child for the same age. Between 2 and 2½ grams of nitrogen is excreted through the urine of an artificially-fed child, while but 1 to 1½ grams is excreted through the urine of a breast-fed baby.

The nitrogen retention is of more importance than other factors, for if there be a good retention it is fair to assume that the child is growing even though it may be losing weight. Such was the apparently paradoxical condition in this case. The child was losing weight daily while on the metabolism frame, yet there was a constant retention varying from 27.6 per cent. to 35.4 per cent. of the intake. This is about the normal retention percentage in healthy artificially-fed children. In healthy breast-fed babies the retention percentage is from 50 to 75 per cent. of the nitrogen intake, but since their intake is much lower, the absolute amount retained does not differ greatly.

Objection has been raised to protein milk feeding because of an initial loss of weight or of the failure to gain weight while on this diet. But one may be assured that in the average case there is a retention of nitrogen and that the musculature of the child is not being drawn on, but that the loss is largely through the water and fat content of the body.

Having considered the protein metabolism we turn our attention to determining some of the other factors in the metabolic process which will account in part for the excellent results following ingestion of this comparatively large quantity of protein.

From clinical observations the most noteworthy change which takes place is in the character of the stools, which change from frequent, green, watery, to pasty, grayish-yellow, smooth stools. It is of much importance to know what chemical changes have taken place in such stools as a result of the ingestion of increased amounts of protein.

In my own series such a study was not undertaken, but there has recently been published a most illuminating piece of work by Holt and Levene,[1] which throws much light on the chemical and physical changes occurring in the feces when fed on a diet either of protein milk or approximating protein milk. These facts have all been brought out in their previous article, but are of such a convincing character that they will bear repetition.

One of their cases (F. H.) was studied over a long period of time under various feedings. From September 14 to October 3 the child was fed fat 2.6 per cent., protein 2.4 per cent., carbohydrate 5 per cent. The description of the stools during this period were "very watery, contained some curds, were foamy, greenish and contained some mucus." Another note states that there were eleven to thirteen stools daily. From October 3 to October 24 the infant was fed on varying percentages of fat, carbohydrate and protein made up from plain milk mixtures. From October 25 to October 29 the same infant was put on three-quarter strength protein milk containing fat 1.9 per cent., protein 2.9 per cent., carbohydrate 2.3 per cent. This formula approximates very closely the formula for full protein milk as made up at Bellevue Hospital, except that it contains about 1 per cent. more fat.

A marked change occurred in the character of the stools shortly after having been placed on protein milk. They were then described as "for the most part pasty, grayish-yellow, smooth, practically normal." A comparison of the chemical findings in the stools of these two periods ought to reveal the changes which take place in them and in a large measure explain the results following protein milk feeding.

A table (Table 2) is presented showing certain chemical and physical characteristics of the stools forty days preceding the giving of protein

milk; also for the four-day period just preceding the giving of protein milk and during the time of giving protein milk.

It will be noted that there was a fall in the total acidity of 100 grams of dried feces, from 900 to 169; that the volatile acids in twenty-four hours in the feces fell from 118.6 c.c. N/10 NaOH to 68.6 c.c.; that the free fatty acids in the feces fell from 1.18 grams in twenty-four hours to .12 gram in twenty-four hours; that the fatty acids at first made up 16.8 per cent. of the total fat in the stool and that these fell under protein milk feeding to 7.9 per cent. With the diminishing of the fatty acids there was a proportional increase in the soaps of the stools. In the first series the soaps made up 17 per cent. of the total fat in the stools; under protein milk the soaps constituted 41.4 per cent. of the

TABLE 2.—CHEMICAL AND PHYSICAL CHARACTERISTICS OF STOOLS PRECEDING AND DURING THE GIVING OF PROTEIN MILK

Child F. H., 8 Mo.	Food Formula Per cent. Fat, Prot., Carbo.	Description of Stools	Total Acidity of 100 Gms. Dried Feces	Volatile Acids in Stools in c.c. N/10 NaOH	Fatty Acids in 24 Hrs. in Grams	Fatty Acids % Total Fat	Soaps % of Total Fat	Water in Feces in c.c.	Total Ash Retained in Gms.
Sept. 14 to Oct. 3	2.6, 2.4, 5.0 Cow's milk mixt.	Greenish watery with curds	903	118.6	1.18	16.8	17.0	251	2.04
Oct. 20 to Oct. 24	1.6, 3.0, 4.7, Cow's milk mixt.	.....	753	112.8	.25	16.2	11.8	128	.36
Oct. 25 to Oct. 29	1.9, 2.9, 2.3, ¾ strength protein milk	Pasty, grayish yellow, smooth	169	68.9	.12	7.9	41.4	40	2.36

total fats. The water loss through the intestine was greatly changed. There was 251 c.c. of water in the feces in the first series and only 40 c.c. lost to the body under protein milk feeding. The mineral salt retention was much better under protein milk feeding. This salt retention according to Langstein and Meyer is one of the most important results of protein feeding. All of the above changes in chemical and physical characteristics have a favorable action on the stools; the lessening of the acidity reduces the irritability of the intestinal mucosa. The production of soaps tends to give bulk and smoothness to the stool; the reduction of the water tends to reduction in number as well as giving form to the fecal matter.

In this discussion I have only referred to the results obtained in two quite widely separated periods. But from a study of the results obtained in the period just immediately preceding the protein milk feeding it will be seen how quickly one may obtain results from a change from the

average cow's milk mixtures to protein milk, thus confirming the clinical observation that it is often necessary to keep a child on protein milk for from four to six days when it may safely be transferred to some other type of feeding.

SUMMARY

In summing up, therefore, one may say that the clinical advantages of protein milk as a corrective for diarrheal conditions in infants are confirmed by the following metabolic findings:

1. The protein intake is not increased sufficiently to be a detriment to the child, but on the other hand, frequently supplies only a sufficient amount to make up for the previous protein depletion.

2. When kept on this high protein intake for but a short period, the specific dynamic action of protein may be disregarded.

3. Even though the food be low in caloric value, and while there may be loss of weight, there is nevertheless sufficient protein retained to prevent waste of muscle tissue and provide for growth.

4. The changes in the stools accompanying protein milk feeding are due to:

   a. A decrease in the total acidity in the stool.
   b. A decrease in the volatile acids.
   c. A decrease in the fatty acids.
   d. An increase in the formation of soaps.
   e. A decrease in the amount of water lost through feces.
   f. There takes place a better retention of the mineral salts.

All of the above factors tend to produce fewer stools through lessened irritability and formed stools through the reduction of water and the formation of soaps.

5. These chemical results may all occur within the space of three or four days, and confirm the clinical observation that in many cases protein milk may be discontinued at the end of a very short period, thus using it as a corrective for diarrheal conditions only and not as a true food.

131 East Sixty-Seventh Street.

THE COMPLEMENT FIXATION TEST IN THE MANAGEMENT OF GONOCOCCUS VULVOVAGINITIS *

GEORGE G. SMITH, M.D.
BOSTON

In the management of gonococcus vulvovaginitis, one is frequently unable to determine whether or not a particular case is cured. The examination of smears is inconclusive; the gonococcus is often undemonstrable, especially in chronic discharges, and even if Gram-negative diplococci are seen within pus-cells, their identity is not always certain. To isolate the gonococcus from a culture medium on which all the other vaginal flora are growing is a task for which few hospital bacteriologists have time. The clinical history and physical condition may point to a complete disappearance of the disease, yet it has been alleged by many observers that, even where the absence of discharge is combined with negative smears, the discharge is prone to reappear. With the hope of securing another criterion of cure, the cases of gonococcus vulvovaginitis in the genito-urinary clinic of the Massachusetts General Hospital have, since January, 1912, been submitted to the complement fixation test.

This test is a serum reaction highly specific for gonorrhea. Broadly speaking, it is similar to the Wassermann test, and has been done, at the Massachusetts General, under the direct supervision of Dr. James Homer Wright.

Two c.c. of blood are drawn from the median basilic vein or cephalic vein into a small Luer or Record syringe. This is not always easy, especially in the case of nervous children, but with experience one meets few failures. A sharp needle is absolutely essential.

I wish to present the results of the application of this test to twenty-five patients. Of these, only a portion had been treated by me. A considerable number were sent from the children's department, to which I am deeply indebted for effective cooperation. The age of these children ranged from 3 to 12 years, and in every one of them gonococci had, at some time, been reported present in smears.

Fifteen of the twenty-five cases gave positive blood-tests; some of these had acquired the disease two, three or even four years before. Of the fifteen, eleven showed suggestive clinical signs, such as redness or discharge, and in four, gonococci were still demonstrable. Of the remaining four, one (Case 24) had shown this organism in the discharge only two months previous, another (Case 16), four months previous to the

*From the Genito-Urinary Department, Massachusetts General Hospital.

test. As it has been stated by Schwartz[1] that the reaction may persist in the blood for several months after the infection has disappeared, the test in these two cases cannot be said to be incompatible with the facts.

The other two were cases which seemed to be clinically well. Case 11 had had no discharge for two years; the smear was negative. Case 12 had had none for one year, and examination showed no signs of vaginitis. In both these cases, the test was only weakly positive, or suspicious.

In only one instance (Case 25) was the test negative in the face of strong evidence to the contrary. In this, a positive culture was obtained by the pathologist. Two months later, blood from the same patient was positive.

Ten cases gave negative tests. Since it has been asserted that this disease is incurable, it behooves us to review the evidence in these cases somewhat more thoroughly. The main facts are as follows:

REVIEW OF TEN NEGATIVE CASES

CASE 1.—Acquired vaginitis in August, 1911. On Nov. 7, 1912, examination showed some redness of the genitals, with a smegma-like material about the introitus. A smear showed no gonococci. This case I should not call conclusive.

CASE 2.—Infected in May, 1911. Feb. 3, 1912, there was no discharge and a smear showed no gonococci. This seems to me adequate evidence of cure.

CASE 3.—The patient suffered rape in November, 1911. She was treated, and one year later reported for observation. Her mother—a careful woman—had seen no discharge for months. We could find none. A smear from the depths of the vagina showed no pus and no gonococci. Conclusive.

CASE 4.—Treated at Long Island Hospital from November, 1911, to April 2, 1912, when she was discharged cured. Our test supported this belief. Conclusive.

CASE 5.—The patient acquired a gonococcus infection six years previously. In 1910 gonococci were still present. Three blood-tests were done: April, 1912, positive; Nov. 23, 1912, suspicious; Dec. 7, 1912, negative. A smear made at the time of the last examination showed no pus and no gonococci. Conclusive.

CASE 6.—Infected in June, 1911. Her mother says she has been all right for a year, and a smear from the depths of the vagina showed no pus and no gonococci. Blood on November 14 was weakly positive and on December 7 was negative. Conclusive.

CASE 7.—Patient contracted the disease in 1907. Examination showed redness of labia, but no discharge. Evidence inconclusive.

CASE 8.—The case is of two years' duration. Mother says there is still some discharge. Also inconclusive.

CASE 9.—Infected October, 1910. For one and one-half years the patient has had no discharge. Conclusive.

CASE 10.—Was infected November, 1911. March 9, 1912, there was no discharge, and her mother has seen none since. Examination on December 13 showed no redness or discharge, and a smear contained no gonococci, and only rare pus cells. Conclusive.

Here are ten negative cases, in three of which the evidence in support of the test is insufficient. This does not prove the test to be at fault, but it does prevent us from pointing to these cases as presumptive cures.

1. Schwartz and McNeil: Am. Jour. Med. Sc., 1911, cxli, 693.

TABLE GIVING DATA OF CASES OF VULVOVAGINITIS IN WHICH THE COMPLEMENT FIXATION TEST WAS USED

Case	Age	Source	Date of Onset	Date of Last Test	Clinical Condition	Smear (Gram's Stain)	Blood
1	6	Sister	8/1911	11/ 7/12	Vulva red; smegma	No gonococci	Negative
2	7	?	5/1911	2/ 3/12	No discharge	No gonococci	Negative
3	5	Raped	11/1911	11/22/12	No discharge for months	No pus; no g. c.	Positive March 14; Negative June 11
4	12	Raped	7/1911	4/10/12	No discharge	.....	Negative
5	11	?	1906	12/ 7/12	No discharge	No pus; no g. c.	April positive; Nov. 23 suspicious; Dec. 7 negative
6	11	?	6/1911	12/ 7/12	No discharge	No pus; no g. c.	Nov. 14 weakly positive; Dec. 7 negative
7	6	?	1907	6/15/12	Labia red; no discharge	.....	Negative
8	3	Sister	1910	6/11/12	Some discharge mother says	.....	Negative
9	6	Hospital	10/1910	12/ 2/12	No discharge for 1½ years	.....	Negative
10	8	?	11/1911	3/ 9/12	No discharge for months	No g. c. Few pus cells	Negative
11	7	?	4/1910	11/23/12	No discharge since August, 1910	No g. c.	Weakly positive
12	12	Hospital	1909	11/21/12	No discharge for one year	.....	Suspicious
13	10	Coitus	6/1910	11/23/12	Slight redness; no discharge	No pus; no g. c.	Oct. 19 weakly positive; November 23 weakly positive
14	10	?	6/1911	5/21/12	Redness, moisture; cystitis	.....	Positive
15	8	?	8/1911	11/14/12	Occasional discharge, mother says	No g. c.	Weakly positive
16	4	Sister	7/1912	11/18/12	No discharge or redness	No g. c.	Positive
17	5	Sister	1/1910	12/ 7/12	No discharge from Apr. to Oct., 1912. Disch'ge since Oct.	Jan. 1911, g. c. Dec. 1912, pus; no g. c.	May, 1912, negative; Oct. 19, '12, weakly positive
18	8	?	9/1912	11/23/12	Some discharge	No g. c.	Strongly positive
19	7	?	1/1912	12/ 7/12	Some discharge	Probable g. c.	Suspicious
20	3	Grandfather	9/1912	12/ 7/12	Some discharge	Pus. No g. c.	Positive
21	9	?	4/1911	11/23/12	Thin yellow discharge	G. c. present	Weakly positive
22	9	Coitus	5/1912	12/ 7/12	Some discharge	G. c. present	Weakly positive
23	11	?	8/1912	11/22/12	Some redness and moisture	No pus; no g. c.	Oct. 19, positive; Nov. 22, positive
24	5	?	1/1911	2/00/12	No discharge	Dec. 29, '11, g. c. present	Positive
25	7	?	1908	5/00/12	Some discharge	March, 1912, g. c. present	March, 1912, negative; May, 1912, weakly positive

Seven cases seem to me to fulfil all requirements, and it is on this evidence that I wish to state my belief that gonococcus vulvovaginitis is a curable disease.

The treatment used in the series has been too varied for tabulation. From my own experience, I should say that the acute cases were much easier of cure, and that once treatment is started, it should be pushed vigorously. Mechanical cleanliness and the prolonged application of silver salts are the principles of treatment. We have used daily potassium permanganate douches 1 to 4,000, followed by the instillation of 10 per cent. argyrol. Douches of sodium bicarbonate, boric acid or salt solution would probably have done as well. The douches should be given through a soft rubber catheter, and after the instillation of argyrol, the child should lie quietly with hips elevated for fifteen or thirty minutes. This treatment can be carried out at home by the mother or visiting nurse The child should be kept from school.

The blood-test has little value so long as easier methods give positive results. But when other signs point to a cure, this test should be used as a court of last appeal.

If in a case proved to be cured the discharge reappears, I believe it to be due to a reinfection, perhaps from the original source. Case 17 illustrates this point. Gonococci were present in January, 1911. After treatment, the discharge cleared up and none was seen, although carefully watched for, from April, 1912, until October. The blood in May was negative. Her sister during this time was also under treatment. In October, a discharge appeared, and the blood on October 19 gave a positive reaction. It seems probable that this patient was cured, as the test done in May would indicate, and was later reinfected from her sister.

SUMMARY

A study of twenty-five cases of vulvovaginitis by means of the complement fixation test shows that the test was positive in eleven out of twelve clinically positive cases, and in four cases in which the evidence was inconclusive. It was negative in three cases in which other evidence of cure was insufficient, but in seven others the clinical findings were corroborative. We are of the opinion that for the purpose of establishing a cure, the test is of considerable value.

DIPHTHERIA SEPTICEMIA WITH REPORT OF A CASE *

EDWARD MORGAN, M.B.
NEW YORK

In a recently published series of blood-cultures in children[1] note was made of a case of bacteriemia due to *B. diphtheriae*. The chief interest in the case lies in the bacteriological findings—cases of true diphtheria septicemia being extremely rare—but the condition is none the less instructive from a clinical standpoint, since the invasion of the blood occurred as a terminal symptom in a case of marasmus.

It is interesting that the first observer to call attention to the fact that *B. diphtheriae* is not always restricted in its activity to the mucous membranes was Loeffler himself. In his original communication[2] on the morphology, cultural characteristics and pathogenicity of the bacillus that Klebs the year before had described, Loeffler reports the isolation of the organisms from the liver at autopsy in a number of instances.

Since then numerous observers have reported similar findings; Babes;[3] Kolisko and Paltauf;[4] Kanthack and Stephens[5] in the spleen; Kutscher[6] in the liver and kidneys; Bulloch and Schmorl[7] in the lymph-nodes; Frosch[8] in the brain, liver, spleen, kidneys, lymph-nodes and in several cases in the heart's blood. These writers inferred as a result of their findings that a diphtheria septicemia must have occurred during life. Support was lent to the belief when Wright,[9] Nowak[10] and Pearce[11] all within a comparatively short period reported positive cultures obtained at autopsy from the heart's blood. More suggestive still was Howard's[12] case of acute ulcerative endocarditis. The bacillus diphtheriae was isolated in large numbers from the vegetations on the valves of the heart. The organism in this case proved to be non-pathogenic for a guinea-pig. The

---

*From the laboratory of The Babies' Hospital.

1. Wollstein, M., and Morgan, E.: Am. Jour. Dis. Child., 1912, iv, 197.
2. Loeffler: Mitteil. a. d. Kais. Gesundheitsamt, 1884, ii, 440.
3. Babes: Bakteriologische Untersuchungen über septische Prozesse, Leipzig, 1889.
4. Kolisko and Paltauf: Wien. klin. Wchnschr., 1889, viii, 147.
5. Kanthack and Stephens: München. med. Wchnschr., 1896, vi, 140.
6. Kutscher: Ztschr. f. Hyg., 1894, xviii, 167.
7. Bulloch and Schmorl: Ziegler's Beitr. z. path. Anat. u. allg. Pathol., 1894, xvi, 247.
8. Frosch: Ztschr. f. Hyg., 1893, xiii, 49.
9. Wright, J. H.: Centralbl. f. Bacteriol., 1895, xviii, 646.
10. Nowak: Centralbl. f. Bacteriol., 1896, xix, 984.
11. Pearce, R. M.: Jour. Boston Soc. Med. Sc., 1898, ii, 92.
12. Howard: Bull. Johns Hopkins Hosp., 1893, p. 33.

most exhaustive work on this subject was done by Bonhoff[13] who published the results of his investigations of the bacteriology of the blood at autopsy in 314 cases of diphtheria. In only thirteen instances was he able to demonstrate *B. diphtheriae* and in ten of these cases it was mixed with another organism, usually streptococcus. The majority of his cases were in children, and ten of the thirteen positive cultures were from children under 7 years of age.

The autopsy records of The Babies' Hospital since 1907 contain four instances of diphtheria bacteriemia discovered post mortem. The clinical history of two of these cases is interesting:

CASE 1.—F. B., aged 5 months, was admitted six weeks before death with an attack of gastroenteritis. The child was well developed but poorly nourished. The throat was normal on admission. The patient showed improvement for two weeks, but diarrhea returned and persisted despite treatment. Nine days before death the temperature rose to 102 F. and thereafter assumed an intermittent type, dropping to 99 once and reaching 104 F. the day before death. Two days before the fatal termination a bloody nasal discharge occurred. The face became edematous, the edema spreading to the extremities on the following day. The cervical and inguinal glands were much enlarged and respiration became rapid and labored. Cultures from the nose and throat showed a profuse growth of *B. diphtheriae*. The same organism was recovered from the heart's blood at autopsy and from the lungs and was proved to be pathogenic for a guinea-pig.

CASE 2.—D. S., aged 1½ years, was admitted with acute bronchopneumonia. Physical examination revealed, besides the pulmonary condition, cancrum oris, osteomyelitis of the superior and inferior maxillae and osteomyelitis of one of the metacarpal bones. In all these three lesions *B. diphtheriae* was demonstrated by direct smear and culture, but it was associated in each instance with *Streptococcus longus*. The temperature was of the remittent type, reaching 102 or 103 F. every day. The child died one week after admission. Cultures from the heart's blood at autopsy showed *B. diphtheriae* and *Streptococcus longus*.

So much for post mortem findings, which are suggestive though not conclusive evidence that true diphtheria septicemia occurs during life. Incontestable proof of this was first advanced by Niessen[14] who obtained the Klebs-Loeffler bacillus in pure culture from the circulating blood of a boy 9 years old suffering from a severe "scarlet fever-diphtheria."

In the next year Roosen-Runge[15] cited another instance in a young adult who was first seen a few days after the onset of bronchopneumonia. Empyema developed and the cultures of the pus from the pleural cavity showed only *Pneumococcus*. After drainage had been established the general condition steadily improved for nine days when the temperature rose again to 103 F. The preceding day the discharge from the chest became hemorrhagic. A blood culture was obtained and showed a pure growth of *B. diphtheriae*. An additional culture two days later confirmed the first finding. Death took place five days after the relapse. Acute

13. F. Bonhoff: Ztschr. f. Hyg., 1910, lxvii, 349.
14. Niessen: Wien. med. Wchnschr., 1902, No. 47, p. 2221.
15. Roosen-Runge: München. med. Wchnschr., 1903, No. 39, p. 1252.

ulcerative endocarditis was found post mortem and *B. diphtheriae* was demonstrated in the valvular vegetations. The bacillus isolated from the blood proved to be non-pathogenic for guinea-pigs.

Mahler[16] four years later, added another case, also in an adult. It is of less interest, since in two of the three blood-cultures made, *B. diphtheriae* was associated with streptococcus. The organism in this case also proved non-pathogenic for animals.

Ucke's[17] patient was a young adult who was admitted to the hospital with a large abscess in the glutcal region, which had appeared two weeks after an attack of typical pharyngeal diphtheria. *B. diphtheriae* was found in pure culture in his blood but the pus from the abscess showed, in addition, staphylococcus and streptococcus. Animal inoculation in this case also was followed by negative results.

In 1909 Hesse[18] reported the case of a patient 23 years of age. The patient was first seen during a typical attack of pharyngeal diphtheria. The angina disappeared but the temperature remained irregularly high. Blood-cultures showed a pure growth of *B. diphtheriae*. An infective endocarditis supervened, with subsequent emboli in the lungs, spleen and brain.

The most recent case is that reported by Leede,[19] in an adult 45 years of age, with a severe pharyngolaryngeal diphtheria. On the sixth day of the disease *B. diphtheriae* and streptococcus were demonstrated in the blood. Death occurred nine days later from complicating pneumonia and empyema. Culture of the heart's blood immediately after death showed only streptococcus.

An analysis of these six cases reveals several interesting facts. 1. The organism isolated from three of the patients proved non-pathogenic for guinea-pigs. The other three were not tested by animal inoculation. 2. Diphtheria antitoxin was administered in three instances, viz., Hesse's, Mahler's and Ucke's cases, apparently without beneficial results. 3. Endocarditis was twice observed as a complication.

The case which prompted this report is unique in that it is the first recorded example of diphtheria bacteriemia in an infant. The clinical history is briefly as follows:

AUTHOR'S CASE

CASE 3.—V. R., female, aged 7 months, was admitted to The Babies' Hospital Feb. 29, 1912, with history of vomiting and progressive loss in weight. The vomiting improved after correction of the feeding but the weight chart continued to show a steady decline. On March 13 a profuse nasal discharge occurred, cultures from which showed the *B. diphtheriae*. The condition improved after administration of antitoxin. On April 14 the temperature rose to 102 F. and

16. Mahler, P.: Berl. klin. Wchnschr., 1907, No. 47, p. 1499.
17. Ucke: Centralbl. f. Bacteriol., 1908, xlvi, orig. p. 292.
18. Hesse, F.: Deutsch. med. Wchnschr., 1909, xxxv, 1096.
19. Leede, Wm.: Ztschr. f. Hyg., 1911, lxx, 104.

for four days remained irregularly high. On the eighteenth a bloody nasal discharge again developed which showed almost a pure culture of *B. diphtheriae*. The same morning blood was taken for culture from the external jugular vein. Death occurred on the night of the nineteenth—thirty-six hours later. There was an ante mortem rise of temperature to 106 F. An autopsy was not permitted.

The blood-culture showed in pure growth a bacillus morphologically indistinguishable from *B. diphtheriae*. In the original broth culture the predominating type was F_1 of Westbrook's classification. Subcultures, however, showed other types, A_1, A and F. There was production of acid in dextrose serum water followed by coagulation of the medium. Lactose serum water was reddened but not coagulated. Saccharose was unaffected.

The organism proved, however, to be non-pathogenic for a guinea-pig. One c.c. of a salt solution suspension from the blood-agar slant of eighteen hours growth produced no local or general reaction when injected intraperitoneally.

A study of recent work by various authors on the pathogenicity of *B. diphtheriae* and the diphtheria-like organisms raises a doubt as to the true nature of the organism in the above case. Pathogenicity for animals is at present recognized as the most reliable method of differentiation. It is probable, however, that there are exceptions to the rule. Williams[20] reported in 1902 her bacteriological investigations during an epidemic of diphtheria in a children's hospital. From the throat of one infant with severe angina in a ward where there were several cases of true pharyngeal diphtheria, morphologically typical diphtheria bacilli were isolated which proved to be non-pathogenic. This case, however, went on to ulceration and later organisms of the same morphology were isolated from the throat and proved to be virulent. This case alone is suggestive.

Strains of many organisms vary greatly in pathogenicity for animals. Pneumococci, for instance, isolated from the circulating blood of a patient suffering from lobar pneumonia, have in many cases proved innocuous when injected into mice. Yet the organisms are unquestionably true pneumococci. Why may not the same hold true with *B. diphtheriae?*

The morphology of the diphtheria-like organism in this case and also its behaviour in the sugar media are both typical of *B. diphtheriae*. More significant, however, is the fact that the bacillus was isolated from the circulating blood of a patient suffering at the time from clinical diphtheria, and I feel satisfied in regarding it as true *B. diphtheriae* in spite of its non-pathogenicity for animals.

It is to be regretted that the organism was not tested for toxin production by forty-eight-hour growth in broth. There is very little production of toxin on solid media in eighteen hours.

It is difficult to draw any conclusion as to the relative frequency of diphtheria bacteriemia, since there is no available report of a series of

20. Williams, Anna: Jour. Med. Research, June, 1902, iii, 83.

blood-cultures in cases of diphtheria which would enable one to estimate the percentage of positive results. Conradi and Bierast[21] believe that there is a temporary bacteriemia associated with every case of diphtheria. They demonstrated *B. diphtheriae* in the urine of fifty-four out of 155 patients examined. Judging, too, from the comparatively high percentage of positive results obtained in heart's blood-cultures, it seems not improbable that the condition occurs more frequently than is generally supposed, especially in those cases that have been termed the "septicemic form" of diphtheria.

In conclusion I would like to express my indebtedness to Dr. Holt for permission to publish this report.

21. Conradi, H., and Bierast: Deutsch. med. Wchnschr., 1912, xxxviii, No. 34, p. 1580.

PROGRESS IN PEDIATRICS

A REVIEW OF SOME RECENT PUBLICATIONS ON ANATOMY AND PATHOLOGY

G. M. SMITH
ST. LOUIS

THE AURICULOVENTRICULAR BUNDLE IN DIPHTHERIA

Ever since Mönckeberg's[1] investigation of the myocardium and bundle of His in connection with cases of death in diphtheria, it has been known that the effect of diphtheria toxin on the auriculoventricular bundle has not been a selective one, and that this special structure of the heart tissue undergoes pathologic changes in this disease quite similar in character to that of the rest of the myocardium. These and other investigations of the heart in diphtheria have often been conducted on patients dying of the disease, who during life did not necessarilly show symptoms typical of cardiac failure or of heart-block. Tanaka[2] examined fifteen hearts of children dying during the course of or after diphtheria. He found that the acute cardiac weakness was due to general myocardial changes without involvement of the auriculoventricular bundle, and he concludes that the changes in the latter tissue can seldom be regarded as the cause of death. Fatty degeneration and a "waxy-like" degeneration of the muscle fibers consisting of loss of cross striations with a partial or complete loss of nuclear staining, were found as the chief changes in the His bundle.

Rohmer,[3] in particular, has taken up recently the study of heart disease in children with special reference to the involvement of the auriculoventricular bundle. His investigations clinically were supported with observations on the heart by means of the electrocardiogram, and for this reason the anatomical findings in cases of heart-block described by him as appearing between two and three days before death, are important and a distinct contribution to this subject. The His bundle from Tawara's node to a point beyond the division into the right and the

1. Mönckeberg, J. G.: Untersuchungen über des Atrioventricularbundel im menschliche Herzen. Jena, 1908.

2. Tanaka, T.: Ueber die veranderungen der Herzmuskulature, vor allem des Atrioventricularbundels bei Diphtherie. Virchows Arch. f. path. Anat. 1912, Bd., ccxcvii, Part 1.

3. Rohmer, P.: Neuere Untersuchungen über den Diphtherieherztod. Jahrb. f. Kinderh., 1912, lxvii, Part 4, p. 391.

left branches was examined in serial section. Rohmer found that, although the myocardium in general gave striking evidence of fatty and inflammatory changes, the bundle of His, in sharp contrast, was only slightly affected and that, too, only in a few scattered places. In both cases the left branch of the auriculoventricular bundle gave evidence in places of a waxy degeneration associated with interstitial changes, but in no region was this more extensive than one-half the diameter of bundle tract. Rohmer supplemented his clinical observations experimentally with the injection of rabbits with sublethal and lethal doses of diphtheria toxin, without being able to produce histologic evidence of injury to the conducting bundle. Rohmer concludes that in diphtheria, pathologic changes in the auriculoventricular bundle are, to a certain degree, independent of changes in other parts of the myocardium, and that the conducting tissue may or may not be affected. At all events, no specific selective action exists on the part of diphtheria toxin for the tissues composing the His bundle. Diphtheria toxins may, however, so affect the conducting bundle from a functional stand-point that a heart-block can be produced without demonstrable anatomical lesions.

THE LESIONS IN THE LUNGS CAUSED BY THE INFLUENZA BACILLUS

Davis[4] points out that during epidemics of influenza, pneumonia is found in 5 per cent. of cases with a mortality that varies between 15 and 50 per cent. Davis has had occasion to study the pneumonic lesion in connection with five cases of influenza meningitis which occurred in children during the first two years of life. The bronchopneumonia developed early in the course of the disease, making its appearance at times even before the development of symptoms indicating an involvement of the meninges. The lungs in all five cases were affected in much the same manner, the lower lobes on both sides showing the principal areas of consolidation. Although a delicate layer of fibrin covered the visceral pleura over the regions of consolidation in the lung, in no case were adhesions formed, nor was there fluid exudate in the pleural cavities. The pneumonia was found to be lobular in character, and morphologically resembled the bronchopneumonia seen as a complication of many other infectious diseases. The author found in these cases histologic evidence of fibrin in the pulmonary alveoli, but this was not abundant. The smaller bronchi appeared to be the site of severest infection. The influenza bacilli were found in the bronchial exudate but associated with other microorganisms. Complications such as hemorrhage, necrosis, abscess, gangrene, or bronchiectasia were not noted in this series of cases.

---

4. Davis, D. J.: The Changes in Influenzal Pneumonia. Jour. Infect. Dis., 1912, x, 259.

BRONCHIOLITIS OBLITERANS

In 1901 Lange[5] described first in adults two cases of disease of the bronchi which he designated as "bronchiolitis obliterans," in which, as the name implies, an obliterating process occurred involving the smaller bronchioles. Since his publication, there have appeared at intervals, descriptions of other cases of quite similar nature affecting both adults and children. In some of these cases the etiologic factor was found in severe irritation of the bronchi, as by inhalation of irritant gases or foreign bodies; in other instances the etiology has been very obscure. Wegelin's[6] case appeared in a child of 3½ years in whose trachea a plum stone had become lodged. The smaller bronchioles and lung alveoli, even at a distance from the primary source of irritation, showed the characteristic lesions at the death of the child seven weeks after the accident. Dunin-Karwika[7] has observed another case occurring in a girl of 16 years. The patient died on the eleventh day of her illness after exhibiting prostration, rapid pulse and respiration, a moderate temperature, and coarse râles over both lungs. The appearance of both lungs was edematous, and the cut surface of the lung showed numerous small prominent whitish nodules suggesting miliary tuberculosis. The microscopic sections, in brief, showed that most of the finer bronchioles were more or less filled with a round, polyp-like, newly-formed tissue continuous at a constricted basal portion with a much thickened and infiltrated peribronchial connective tissue. The alveoli of the lung, also, in places were compressed by thick fibrous septa that were continuous with the peribronchial tissue. In some regions there was noted in the alveolar spaces an actual ingrowth of connective tissue similar to that which so typically affected the bronchioles. Dunin-Karwicka believes that the intrabronchial connective tissue masses have their origin from the connective tissue around the bronchioles, and the latter condition represents an inflammatory reaction of the peribronchial lymphatics induced by gaseous, mechanical, or bacterial irritation. Other observers have thought that an injury to the bronchial epithelium is the earliest lesion; and that the fibrinopurulent exudate in the lumen of the bronchiole, in a chemotactic way possibly, causes an ingrowth of the connective tissue from the bronchial wall, and in this way undergoes an organization. A possible bacterial origin of the disease is suggested by the sudden onset with a chill and the subsequent febrile course, both of which have been described clinically in association with the respiratory symptoms. In this connec-

5. Lange: Ueber die eigentumlichen Erkrankungen der kleinen Bronchien und Bronchiolen. Deutsch. Arch. f. klin. Med., 1901, lxx, 342.

6. Wegelin, C.: Ueber Bronchitis obliterans nach Fremdkorperaspiration. Beitr. z. path. Anat. u. z. allg. Path., 1908, xliii, 439.

7. Dunin-Karwicka, Marie: Ueber bronchiolitis obliterans. Virchows Arch. f. path. Anat., 1912, ccx, 87.

tion, it may be added, acute parenchymatous changes have in some instances been found in the liver, the kidneys, and in the lymph-nodes. Although the condition of bronchiolitis obliterans may unquestionably be of secondary character, Dunin-Karwicka concludes from the study of her own case and a critical review of the literature that this disease of the bronchioles may be of a primary nature.

INFANTILISM ASSOCIATED WITH FUNCTIONAL AND ORGANIC LESIONS IN THE KIDNEY—RENAL INFANTILISM

About two years ago Fletcher[8] described a case of infantilism associated clinically with symptoms of polyuria and exhibiting post mortem advanced sclerotic changes in the kidney. Since this publication a number of other writers have reported similar cases of infantilism which apparently find as their chief visceral symptom a striking disturbance of renal function. Miller and Parsons[9] divide renal infantilism into two groups. Group 1. Renal infantilism with organic renal disease (chronic interstitial nephritis). Group 2. Renal infantilism without organic renal disease (diabetes insipidus). The first group, the authors have again subdivided into cases of congenital nature exhibiting or not cardiovascular changes, and also a form of renal infantilism originating after birth.

Miller and Parsons have not alone followed clinically a number of these cases, but also have had opportunity of studying the lesions post mortem. The children of this type gave as a symptom during life a polyuria associated constantly with exaggerated thirst. The urine showed the presence of varying amounts of albumin and sometimes casts. The physical and the mental growth of the infant was very slow; so that, for instance, at the age of 9, one patient resembled a child of 3.

At autopsy the striking lesion was seen in the kidneys. Both kidneys as a rule were small, with coarsely granular surface. The cortex was found much decreased in size and the pyramids fibrous. Microscopically the principal change was a marked increase of connective tissue affecting the whole organ. The glomeruli showed extreme fibrous and hyaline changes, the tubules exhibiting dilatation and atrophy. The heart muscle gave evidence of hypertrophy and moderate fibrous changes in some instances. No detailed histological descriptions of the ductless glands are included in the autopsy reports and it is therefore assumed that these appeared normal. A case, exhibiting infantilism, polyuria without an albuminuria (Group 2, renal infantilism without organic

8. Fletcher, M.: Case of Infantilism with Polyuria and Chronic Renal Disease. Proc. Royal Soc. Med., 1910, Part 1, p. 93.

9. Miller, R. and Parsons, L.: Renal Infantilism. Brit. Jour. Child. Dis., 1912, ix, 289.

renal disease, diabetes insipidus), was reported only from the clinical standpoint. Miller and Parsons think that syphilis could be excluded as a factor causing the interstitial changes in the kidney; and they do not believe that the condition of infantilism is due to an internal renal secretion. This class of symptomatic infantilism the authors conclude, is secondary to a perversion of the renal functions, and they "regard the stunting of the growth as due to excessive drainage from the persistent polyuria and albuminuria."

THE HISTOLOGICAL CHANGES OCCURRING IN THE ADRENAL GLAND DURING INFANCY

The studies of Kerr[10] on the anatomy of the adrenal gland confirm, to a great extent, the earlier observations of Kawamura[11] and also Thomas,[12] both of whom have shown that the adrenal gland in the course of the first year of life undergoes a definite degeneration of its inner cortical cells. Kern's work aimed at a systematic study of the adrenal gland from the time of birth, through the various periods of childhood until the twelfth year. The technic employed for the examination of tissue was a simple one, and consisted in the preparation of frozen sections of adrenal tissue after fixation in Formal-Müller solution. The stains employed were those commonly used for tissues, including the stains for fat.

As a result of these studies Kern divides the changes occurring in the adrenals of infancy and childhood into four stages. The first stage, seen at the time of birth, shows as a characteristic distinction a marked hyperemia in the capillaries of the innermost zone of the adrenal cortex. The hyperemia gradually causes a separation of the cells of this layer with evidence of compression and beginning degeneration of the cytoplasm and nuclei of its cells. The second period occurs in children at about the end of the first month and extends to about the end of the first year. During this period the degeneration of the inner layer of the cortex becomes more distinct, and at the same time the cells of the medullary area are developed. The latter include both chromaffin cells and the perivenous cortical cells of the medulla. The third period is concluded on the average near the end of the first year. The characteristics of this period are the gradual subsidence of the hyperemia of inner cortex and the cessation of degeneration of its cells. The chromaffin cells of the medulla become well developed, and are separated from the cortex by circularly arranged interstitial tissue of the zone which had previously

10. Kern, H.: Ueber den Umbau der Nebenniere in Extrauterin Leben. Deutsch med. Wchnsch., No. 21, p. 971, 1911, No. 21, p. 971.

11. Kawamura: Die Cholesterinverfettung (Cholesterinsteatose). Fischer, 1911.

12. Thomas: Ueber die Nebennieren des Kindes und ihre Veranderung bei infectionskrankheiten. Ziegler's Beitr. z. path. Anat. u. z. allg. Path., 1911, 1.

undergone degeneration. The fourth period extends indefinitely from the first year until period when growth ceases. In this period the connective tissue capsule separating medullary and cortical cells, gradually is reduced, and the final adult arrangement of cells is assumed.

In his studies on the adrenals of various animals Kern was not able to find anything analogous to the human stages of degeneration; nor could Delwitsky,[13] after examining at different periods of life the adrenals of rats, find in the growth of the glands of this animal any of the phenomena of degeneration as seen in man.

In connection with the definite stages of growth exhibited in the adrenal of the normal child, it is of interest to note that in abnormal conditions of development as seen, for instance, in anencephaly, the degenerative processes of the cortex may be especially rapid in onset. R. Meyer[14] who has recently studied the adrenal gland in cases of anencephaly found, however, that the adrenal may appear in such instances of anencephaly entirely normal in all its histologic details. Still, in half the cases of anencephaly in which the adrenal was found to be present in the body, Meyer noted that the medulla of the gland was hyperplastic and differentiated to a stage beyond what was the usual for a normal fetus of corresponding age. Where a diminution in the size of the gland exists in anencephaly, this occurs as a result of an early degeneration of the zona reticularis and the inner part of the zona fasciculata, the two zones which physiologically undergo degeneration during the first year of life. In nearly one-half the cases of anencephaly Meyer found that the whole adrenal on one or both sides was absent.

THE THYMUS

Although within a short period of time there have appeared publications, notably by Hammar,[15] Biedl[16] and Schridde,[17] presenting in a most complete manner our present knowledge of the thymus in health and disease, still a number of recent communications have again fixed attention on this organ.

---

13. Delwitsky, W. L.: Beiträge zur Histologie der Nebennieren. Ziegler's Beitr. z. path. Anat. u. z. allg. Path., 1912, xxv, 431.

14. Meyer, R.: Nebennieren bei Anenzephalie. Virchows Arch. f. path. Anat., 1912, ccx, 158.

15. Hammar, T. A.: Fünfzig Jahr Thymus forschung, Kritische Uebersicht der Normalen Morphologie. Ergeb. d. Anat. u. Entwicklungsgesh, 1910, XIX, 1-274.

16. Biedl, A.: Innere Sekretion. Ihre physiologischen Grundlagen und ihre Bedeutung für die Pathologie, 1910, p. 107.

17. Schridde, H.: Thymus, in Aschoff's Pathologische Anatomie, 1911, ii, 166.

Weidenreich,[18] has apparently placed beyond doubt the fact that the thymus should be regarded as an organ which is active throughout nearly the entire period of life, in the production of white blood-cells. This conclusion was reached from the morphologic study of very freshly fixed material taken from normal persons who had been executed and from one who met death by drowning. Weidenreich found that in man the cortical cells of the thymus are typically lymphocytes which present not alone the morphologic characteristics of such cells, but possess also the peculiar property of differentiation in the direction of granular leukocytes. He noted that in the thymus both the eosinophil and neutrophil granular leukocytes developed from the non-granular lymphocytes, and also the remarkable fact that differentiated forms of granular leukocytes were developed in the thymus through mitotic division. He points out that this is the first time mitotic division of granular leukocytes has been observed under normal conditions outside of the bone-marrow.

The forms of leukocytes which Weidenreich found produced in the human thymus included the myelocytes, lymphocytes, plasma cells, mast cells and the eosinophil and neutrophil leukocytes, with transitional forms of leukocytes.

He believes that these forms of blood-cells after reaching their proper stage of development, are removed from the thymus by means of lymph-vessels and in this way reach the general circulation.

Weidenreich was unable in any case to demonstrate the formation of red blood-cells in the thymus, as nucleated red blood-cells or other embryonal forms did not appear. His findings, he believes, are of significance in proving that the formation of granular leukocytes does not occur exclusively in the bone-marrow. It is of interest to note that the evidence of active white blood-cell formation occurred even in a man who was 39 years old. This would lead to the belief that the activity of the gland is not limited merely to the earlier periods of life. Indeed, several writers of late have pointed out that the thymus may exist in a perfect state of development even after mid-life. It has been suggested that the well-known atrophy of this organ may in part be due to the decrease in size which is known to occur very rapidly under abnormal conditions of metabolism.

Weidenreich confines his observations entirely to the study of the thymus cortex. In his publication he makes no attempt to determine the relation of the cortex to the epithelial elements of the medulla. Whether or not the medullary part of the thymus with epithelial cells

18. Weidenreich, Franz: Die Thymus des Ernachsonen Menschen als Bildungsstätte ungranulierte und granulierte Leukobyten. München med. Wchnschr., 1912, xlviii, 2601.

developed from the branchial clefts is possibly associated with a specific function of the gland, is not discussed in the paper.

THE THYMUS IN CONGENITAL SYPHILIS

Ribbert[19] has recently contributed to the subject of congenital syphilis of the thymus, approaching the subject from the standpoint of developmental disturbances in the thymus due to lues. He concerns himself with the lesion known as Dubois' abscesses which are known to occur in the gland in congenital syphilis, and which, as the result of the studies of Eberle,[20] are generally regarded as collections of pus occupying preformed cavity spaces representing the dilated epithelial canals of the thymus anlage.

The case in point, studied by Ribbert, was a syphilitic new-born infant, exhibiting typical symptoms of lues, including an osteo-chondritis. The thymus, the size of a pigeon egg, allowed on section an escape of pulpy, gray-yellow purulent material, representing the content of several cystic cavities occupying the substance of the gland. The microscopic examination of this exudate showed it to consist of masses of cells resembling pus cells, necrotic in character, with nuclei, for the most part, that could not be definitely distinguished. The organ, as a whole, was composed histologically of a system of cavities held together by loose connective tissue. The inner lining of the cavity wall consisted of a stratified squamous epithelium. Next to the epithelial layer was found a clear zone of connective tissue, external to which, in a third zone, were irregular masses of lymphoid cells. Ribbert, like Eberle, believes that these cystic cavities of the thymus represent the original spaces of the canal system of the thymus, dilated by an accumulation of cellular exudate. The original epithelium remaining as a lining to the cavities, undergoes a further development, and becomes a stratified squamous epithelium like that of the pharynx. No Hassall's bodies were found. In general, the relation of epithelium to lymphoid tissue resembles that seen in the region of the tonsils. Ribbert regards the cystic condition of the thymus as an arrest in the development of the gland, and believes that histologic study establishes the fact that the cortical cells of the thymus are not developed from the medullary epithelial cells. In this regard he opposes the well recognized view held by Stoehr.[21] The histologic relations of Dubois' abscesses, Ribbert adds, vary in appearance according to period of development in which the syphilitic infection of the thymus has taken place; and therefore the

19. Ribbert, H.: Die Entwicklungsstörrung des Thymusdrüse bei congenitales Lues. Frankfurter Ztschr. f. Pathol., 1912, xi, 209.

20. Eberle: Ueber Congenitale Lues des Thymus. Dissert., Zurich, 1894.

21. Stoehr, P. L.: Ueber die Abstammung der kleinen Thymusrindenzellen. Anatomy, 1910, xl.

findings in his case, representing an unusually early affection of the thymus do not necessarily picture the condition when syphilitic involvement of the thymus has occurred at a stage of later fetal development.

STATUS THYMUS LYMPHATICUS

Schridde,[22] during the past year, has had opportunity to study a number of cases of death associated with status thymus lymphaticus and has grouped the lesions found in these cases as characteristic of this condition. At autopsy, he found the skin in cases of status lymphaticus death to be of a peculiar pallor, the subcutaneous fat well developed, pale yellow, and unusually moist. The normal thymus, weighing 12 gm. in the new-born and between 20 and 25 gm. at puberty, involutes, according to the author, so that between the twentieth and twenty-fifth years only traces of the thymus are found. In instances of status lymphaticus Schridde has found that the thymus might weigh between 60 and 80 gm. As a rule the hypertrophy is not so marked, occasionally the organ is normal, or, indeed, below the normal in weight. The microscopic changes in the thymus, the writer considers to be constant and characteristic. These consist of a distinctive hyperplasia of the medulla associated with an underdeveloped yet otherwise normal cortex. Hassall's corpuscles are, however, relatively few in number yet large in size. They do not exhibit the usual morphology, but consist, for the most part, of centrally located fatty masses without nuclei. This typical hyperplasia of the medulla of the thymus is present as a lesion in instances of status thymolymphaticus not alone found in children but also in adults. It is characteristic of both the small thymus as well as of the enlarged thymus that may be found in this condition.

Besides the changes in the thymus, Schridde finds that a hyperplasia of the malpighian corpsucles of the spleen is constantly present, which at times lead to a visible enlargement of the organ. Conspicuous hyperplasia of the lymphatic tissue of the gastro-intestinal tract is also encountered. In this connection, Schridde emphasizes the enlargement of the lymphatic follicles at the base of the tongue and the tonsils. The constant hyperplasia of the lymph follicles of the tongue, Schridde considers to be especially important in distinguishing clinically cases of status thymus lymphaticus. Two specific instances are cited in which death in patients with status lymphaticus followed the injection of salvarsan, the first in a boy 10 years of age, the second in a woman of 50.

EXPERIMENTAL OBSERVATIONS ON THE THYMUS

The slowly accumulating evidence that the thymus has a rôle as an organ of internal secretion has gained support by the remarkable obser-

22. Schridde, H.: Die Diagnose des Status thymolymphaticus. München. med. Wchnschr., 1912, xlviii, 2605.

vation on the metamorphosis of the tadpole, made by Gudernatsch[23] in feeding experiments. The experiments have been conducted since 1911 and are published as a preliminary note in 1912. In brief, tadpoles of different ages were fed various mammalian tissues, and among these thyroid and thymus. The effects on the developing tadpole fed on thyroid and thymus were opposite in character. Fed with thyroid, growth of the tadpole ceased but metamorphosis began at once, with the final result that small dwarfed frogs were produced. On the other hand, animals fed with thymus, continued to grow rapidly and formed large tadpoles. In some of these animals fed on thymus, a metamorphosis failed entirely to make its appearance.

The studies of Klose[24] and Matti[25] on thymectomized dogs have also revealed the close relationship between the thymus and processes of development, especially with regard to the growth of bone. Klose found that puppies about 10 days old are most suitable for these experiments because at this age the gland is relatively large, bearing a relation of 1 to 170 to the body-weight, and is then possibly most active. Reduction of the size of the gland is rapid soon after the tenth day, so that at the end of the third month the proportion to the body-weight is 1 to 1,200 or 1,600. Excision of the thymus was performed under most careful surgical technic in order to insure a complete removal of the gland. Small gland rests left behind proved to be the source of a rapid regeneration of the whole gland. Matti[25] like Klose, found that practically no changes occurred in thymectomized dogs until after a period of latency of about four weeks, when the animal developed a general weakness, various curvatures of the long bones, and a definite inhibition in the growth of the bones of the legs which was very apparent when compared with the normal control dogs of the same litter. Interference with growth became gradually more conspicuous from this time on. The development of the skull was retarded and even a typical "rosary" was noted at the costochondral junction of the ribs. The slow but progressive cachexia resulted eventually in the death of the animals. Matti believes that morphologically the changes in bone found in thymectomized animals agrees closely with those described as occurring in human and also animal rachitis and that these depend chiefly on the fact that a calcium assimilation by newly-formed and over-produced osteoid tissue does not take place. The characteristic weakness in voluntary muscles exhibited by the thymectomized animals, was found histologically to be

23. Gudernatsch, T. F.: Fütterungsversuche an Amphibrenlarven. Zentralbl. f. Physiol., 1912, xxvi, 323.

24. Klose, H.: Nerve Thymus forschungen und ihre Bedeutung für die Kinderheilkunde. Arch. f. Kinderh., 1911, lv, 1-50.

25. Matti, H.: Untersuchungen über die Wirkung experimentelles Ansschaltung der Thymusdrüse. Mitteil a. d. Grenzgeb d. Med. u. Chir., 1912, xxiv, 665.

associated with atrophy and evidences of other forms of degeneration in the muscle cells. The study of the various other organs of the dogs in whom the thymus had been removed at an early age leaves still in doubt the question of interrelation between thymus and these organs. Hypertrophy of the medulla of the adrenal appeared, however, to be a constant finding associated with the removal of thymus in the young dogs of Matti's experiments.

MELENA NEONATORUM

Advances in the study of the physiology of blood coagulation have resulted in throwing considerable light on a number of hemorrhagic diseases occurring not alone in adults but also in children. Whipple[26] by an analysis of the elements of coagulation has been able to demonstrate the fact that, in a number of hemorrhagic diseases, the normal balance between the elements instrumental in the production of coagulation may become so affected as to bring about the occurrence of hemorrhages with the sequence of symptoms and lesions which have become recognized as characteristic of disorders of this nature. Of interest, in particular, was the study of a case of melena neonatorum. A new-born child apparently healthy at the time of birth, developed bleeding from the nose, foreskin and intestine, together with jaundice. Death occurred on the fifth day. The blood from this patient remained uncoagulated even after twenty-four hours contact with tissues in the body and the absence of antithrombin, in consequence, was excluded as a causative factor of non-coagulation. Fibrinogen and calcium were tested for and found present in the usual amounts. Thrombin and prothrombin were found to be the essentials lacking in the production of the coagulation process in the case in point. Of interest were the histologic findings in the lung alveoli, which showed the presence of old fibrin, but none of fresh formation, indicating, as Whipple points out, that the necessary elements of coagulation were present at the time of birth, yet disappeared in the next few days during which the fatal symptom developed.

The use of injections of blood-serum with its thrombin becomes, as a result of these observations, a valuable therapeutic measure in cases of melena of this nature.

PATHOLOGY OF ACUTE POLIOMYELITIS

Peabody, Draper and Dochez[27] in a monograph on acute poliomyelitis devote a chapter to a consideration of the pathology of this disease. The authors emphasize at the outset that acute poliomyelitis is essentially a general infection, although heretofore chiefly the lesions of the central

26. Whipple, G. H.: Hemorrhagic Disease. Septicemia—Melena Neonatorum, and Hepatic Cirrhosis. Arch. Int. Med., 1912, ix, 635.

27. Peabody, F. W., Draper, G., Dochez, A.: A Clinical Study of Acute Poliomyelitis. Monographs Rockefeller Inst. Med. Research, 1912, p. 18.

nervous system have been studied. The probable path of entry of the virus through the lymphatics of the nasal passages to the meninges is discussed and the anatomic relation of the perivascular lymph spaces of the meningeal vessels to the cerebrospinal fluid is pointed out. The earliest changes in the cord are found in the hyperemia and round-cell collections in the lymph spaces that surround the blood-vessels entering the anterior and lateral aspects of the spinal cord. The cellular exudate, edema, small hemorrhages and probable direct toxic action of the virus, are regarded as responsible for the degenerative changes in the nerve cells of the cord, affecting both the gray and the white matter. Histologic changes in the posterior root ganglia are found to be of constant occurrence. The brain, medulla and pons may also show a hyperemia, cellular infiltration about the vessels and degeneration of the nervous elements. In organs other than the nervous system changes of constant occurrence were noted. In brief, lymphatic glands, thymus and spleen reacted to the virus by swelling, and histologically the endothelial cells of the germinal centers were found large, swollen and pale. Phagocytosis was active in the lymphatic glands; degeneration of both lymphoid and endothelial cells with even extensive necrosis are described. A proliferation of the endothelial cells of the lymph-sinuses was also seen. Conspicuous histologic changes were found in the liver, where, like in typhoid fever, areas of necrosis with lymphoid cells and polynuclear leukocytes were seen.

TUBERCULOSIS OF BONE

Fraser[28] has studied the tuberculous lesions of bone in eighty human cases, beside the experimental lesions of bone produced in rabbits and guinea-pigs. The subject of bone tuberculosis he discusses from the following standpoint: (a) The development of the primary tubercle; (b) associated changes in the marrow, periosteum, bone lamellae and blood-vessels; (c) the gross pathologic varieties of bone tubercle; (d) necrosis and sequestrum formation.

Fraser finds that the tubercle bacillus enters the marrow either through the blood-stream (intravascular infection) or through the lymphatics closely associated with the blood-vessels (perivascular infection). The tubercle developed as a result of intravascular infection is rare, and is thought to be produced by the occlusion of a small blood-vessel of the marrow by an embolus of tubercle bacilli. The perivascular infection is secondary to tuberculous inflammation of adjacent synovial membranes and the development of the tubercle is characterized as a gradual process. The histology of tubercle formation differs in a number of ways, dependent on one or the other method of infection. The final appearance of

28. Fraser, T.: The Pathology of Tuberculosis of Bones. Jour. of Pathol. and Bacteriol., 1912, xvii, No. 2, p. 254.

tuberculous tissue is, however, much the same in each mode of infection. A central cystic degeneration of the tubercle is found to be of frequent occurrence in later stages of the disease. Calcification of nodules is rare, although this may occur after a primary deposit of calcium in a giant cell has extended to the rest of the tubercle.

Of considerable interest is the detailed study of the associated changes taking place in the affected bone during the period of tubercle development. In the earliest stages of the disease immature forms of polymorphonuclear leukocytes and shortly afterward polymorphonuclear neutrophil leukocytes appear, both types exhibiting high phagocytic powers. Nucleated red cells increase in number and gigantoblasts at times are found. The polynuclear leukocytes are replaced by the lymphocytes and mononuclear cells. Fibrous changes in the marrow follow on the cessation of active growth in the tubercle, the connective tissue cells being derived from the connective tissue cells lying among the fat cells, and also from the perivascular tissue. The bone lamellae now undergo either rarefaction or thickening. In the former process bone absorption is effected through the cellular activity of osteoclasts or through a chemical change in the lamella, noted by characteristic staining reaction associated with the disappearance of calcium. The fibrous elements of the bone lamellae alone remain. Lamellar thickening was found in most of the chronic forms of bone tuberculosis, commonly accompanied by an obliterative endarteritis. The fibrosis of blood-vessels, the author believes, is due to the circulation of a tuberculous toxin, through the vessel. The lesion affects the smaller vessels and occasionally the primary divisions of the nutrient artery. Fibrous changes in the bone-marrow are attributed to disturbances of nutrition induced by the vascular changes in the blood-vessels. Besides the general discussion of tuberculosis affecting bone, the author describes in detail the changes found in six different forms of tuberculous disease of bone. These are (1) the encysted tuberculous lesion, (2) the infiltrating lesion, (3) intermediate form of lesion, (4) atrophic, (5) hypertrophic and (6) the acute miliary lesion. Spina ventosa and the formation and characters of different kinds of sequestra have also received careful description.

10 North Kingshighway.

INDEX TO CURRENT PEDIATRIC LITERATURE

ANATOMY AND PHYSIOLOGY

Milk, Human, Transmission of Hemagglutinins in.—J. v. Zubrzycki and R. Wolfsgruber.
Deutsch. med. Wchnschr., Jan. 30, 1913.

Ossification Centers in Fetal Pelvis. (Knochenkerne des fetalen menschlichen Beckens.)—I. Obata.
Ztschr. f. Geburtch. u. Gynäk., 1913, lxxii, No. 3.

HYGIENE

Medical Inspection of Schools.—H. MacMurchy.
Canad. Med. Assn. Jour., February, 1913.

School Children, Colorado Method for Examination and Care of Public.—M. E. Bates.
New York Med. Jour., Feb. 22, 1913.

Schools, Routine Disinfection of.—J. T. A. Walker.
New York Med. Jour., Feb. 15, 1913.

BACTERIOLOGY AND PATHOLOGY

Addison's Disease in a Boy Aged Ten Years.—F. Langmead.
Lancet, London, Feb. 15, 1913.

Congenital Absence of Both Thumbs.—J. H. Sequeira.
Lancet, London, Feb. 8, 1913.

Congenital Malformations of the Neck; Five Cases. (Les formations branchiogènes du cou.)—L. Delrez.
Arch. gén. de Chir., January, 1913.

Dental Arches, Abnormal.—A. Zentler.
Arch. Pediat., January, 1913.

Dental Caries in Its Relation to General Pathology. (De l'érosion dentaire envisagée au point de vue de la pathologie générale.)—Coustaing and Filderman.
Rev. de méd., January, 1913.

Hyperpyrexia in the Rectum in Children. (Ueber rektale Hyperthermie im Kindesalter.)—E. Moro.
Monatschr. f. Kinderh., 1913, xi, No. 9.

Monster, Trunkless. (Cas de défect partiel congenital de la colonne vertébrale at de la moelle épinière avec fente throaco-abdomino-pelvienne.)—P. Stauffer.
Rev. méd. de la Suissse romande, Feb. 20, 1913.

Noma.—T. F. Clay.
Mississippi Med. Month., March, 1913.

Rachitis.—M. Kassowitz.
Deutsch. med. Wchnschr., Jan. 30, 1913.

Scorbutus, Infantile, in Children.—F. Glaser.
Berl. klin. Wchnschr., Feb. 3, 1913.

Thymus with Exophthalmic Goiter, The. (Zur Histologie des Basedowthymus.)—P. Bayer.
Arch. f. Gynäk., 1913, xcix, No. 1.

Tubercle Bacilli, Human, in Milk of Vaccinated Cow.—A. S. Griffith.
Jour. Path. and Bact., Cambridge, January, 1913.

Tumors, Abdominal, in Children.—A. Lorenzini.
Reforma Medica, Feb. 1, 1913.

METABOLISM AND NUTRITION

Alimentary Anaphylaxis to Eggs. (Anaphylaxie alimentaire aux œufs.)—E. Lesné and C. Richet.
Arch. de méd. des enfants, February, 1913.

Feeding, Artificial Infant.—J. T. Scott.
Jour. Kansas Med. Soc., February, 1913.

Feeding in Later Infancy.—H. H. Yerington.
California State Jour. Med., February, 1913.

Feeding in Relation to Teeth.—G. C. Kusel.
Arch. Pediat., January, 1913.

Infant-Feeding.—J. L. Morse.
New York Med. Jour., March 8, 1913.

Metabolism of Matter and Energy in Infants.—A. Schlossman.
München. med. Wchnschr., Feb. 11, 1913.

Metabolism in Osteomalacia. (Stoffwechselversuche bei Osteomalacie.)—L. Zuntz.
Arch. f. Gynäk., 1913, xcix, No. 1.

Milk, Desiccated. (Essai sur la valeur alibile du lait dess'eché.)—G. Variot and others.
Bull. de la Soc. de pédiat., January, 1913.

Milk in Nursing, Aspiration of. (en merkelig dodsaarsak hos et spaedbarn.)—J. Hjort.
Norsk Mag. f. Laegevidenck, February, 1913.

Milk, Effects of Heated and Superheated, on Infant's Nutrition.—H. L. Coit.
Arch. Pediat., February, 1913.

Scorbutus, Infantile; Three Cases.—J. Comby.
Arch. de méd. des enfants, February, 1913.

DISEASES OF THE NEWLY-BORN

Adenoma of the Umbilicus. (Zur Kasuistik und Histogenese der Nabeladenome.)—A. Zitronblatt.
Deutsch. med. Wchnschr., Feb. 20, 1913.

Children, Abnormally Large at Birth. (Riesenkinder.)—F. Ahlfeld.
Ztschr. f. Geburtsh. u. Gynäk., 1913, lxxii, No. 3.

Chorea of the heart.—C. Aubertin and M. Parvu.
Presse méd., Jan. 25, 1913.

Germs in Vagina, Transmission of, Child During Delivery. (Uebergang von mutterlichen Scheidenkeimen auf das Kind wahrend der Geburt.)—F. Noack.
Ztschr. f. Geburtsh. u. Gynäk., 1913, lxxii, No. 3.

Hemorrhages in the Newly Born, Intracranial. (Zur Genese und Symptomatologie intrakranieller Blutungen beim Neugeborenen.)—H. Abels.
Arch. f. Gynäk., 1913, xcix, No. 1.

Meningeal Hemorrhage in the Newly Born, Operative Treatment of. (Etiologie, symptomes et traitement chirurgical des hémorragies meningées du nouveau-né.)—J. Doazan.
Arch. gén. de chir., January, 1913.

Pulmotor, Infant: Apparatus for Artificial Respiration on Asphyxiated Newborn.—J. C. Edgar.
Am. Jour. Obst., February, 1913.

Skull in Newborn, Immediate Treatment of Depressed Fracture of.—G. W. Kosmak.
Am. Jour. Obst., February, 1913.

ACUTE INFECTIOUS DISEASES

Chorea.—P. H. Markley.
New York Med. Jour., March 1, 1913.

Contagious Diseases in Infant Wards, Prophylaxis of. (La defense contre les maladies contagieuses á l'asile de débiles de médan.)—H. Méry and Malhéné.
Bull. Soc. de pédiat., January, 1913.

Diphtheria Antitoxin Refound in Serum and Proper Dosage. (Nachweis von Diptherican-antitoxin im Blutserum der damit behandelten Kranken und Dosierung des Heilserums.)—C. Schöne.
Deutsch. med. Wchnschr., Feb. 20, 1913.

Diphtheria Bacilli in the Urine.—W. Beyer.
München. med. Wchnschr., Feb. 4, 1913.

Diphtheria, Blood-Pressure in. (Zur Frage der praktischen Bedeutung der Blutdruckmessung bei der Diptherie.)—J. M. Brückner.
Deutsch. med. Wchnschr., Feb. 20, 1913.

Diphtheria, Prophylaxis and Early Treatment of. (Bedeutung und Durchführbarkeit von Prophylaxe und Frühbehandlung der Diptherie.)—W. Braun.
Deutsch. med. Wchnschr., Feb. 6, 1913.

Diphtheria, Sore Throat, etc.—H. I. Goldstein.
Jour. New Jersey Med. Soc., February, 1913.

Diphtheria, Use of Bouillon Culture of Staphylococcus Pyogenes Aureus in.
New York State Jour. Med., February, 1913.

Diphtheritic Paralysis. (Diphtérie paralysante.)—I. David.
Arch. de méd. des enfants, February, 1913.

Headache in Acute Infections. (Cephaleé dans les maladies infectieuses aigues.)—H. Roger and J. Baumel.
Rev. de méd., January, 1913.

Hexamethylenamin in Typhoid. (Les injections sous-cutanées d'urtropine dans la traitement de la fiévre typhoide.)—H. Triboulet and F. Lévy.
Presse méd., Feb. 22, 1913.

Meningitis by Drainage of Cisterna Magna, Treatment of.—I. S. Haynes.
Arch. Pediat., February, 1913.

Meningitis, Epidemic.—F. J. Slataper.
New York Med. Jour., Feb. 15, 1913.

Meningitis, Epidemic Cerebrospinal.—A. E. Thayer.
Southern Med. Jour., February, 1913.

Meningitis, Serum Treatment of Cerebrospinal.—C. C. Green.
Southern Med. Jour., February, 1913.

Meningitis, Sinus Thrombosis with Purulent.—I. Lederman.
Colorado Med., February, 1913.

Poliomyelitis.—M. K. Wylder.
New Mexico Med. Jour., February, 1913.

Poliomyelitis in Norway, Acute.—A. Johannessen.
Monatschr. f. Kinderh., 1913, xi, No. 9.

Poliomyelitis, Transmission to Monkeys of Virus Obtained from English Cases.—J. McIntosh and H. Turnbull.
Lancet, London, Feb. 22, 1913.

Pseudotetanus, Case of Escherich's.—O. Witzinger.
Ztschr. f. Kinderh., January, 1913.

Scarlet Fever. (Therapie des Scharlachs.)—E. Benjamin.
Therap. Monatsh., February, 1913.

Scarlet Fever, Factors Concerned in Spread of.—S. C. Lind.
Cleveland Med. Jour., February, 1913.

Scarlet Fever; Is Desquamatory Stage Contagious?—F. H. Mead.
Med. Rec., New York, Feb. 15, 1913.

Sprue, Rôle of Fungi in.—A. Castellani and G. C. Low.
Jour. Trop. Med. and Hyg., London, Feb. 1, 1913.

Tetanus, Cure of, by Magnesium Sulphate. (Weitere Beobachtungen über die Heilung des Tetanus mit Magnesiumsulfat.)—T. Kocher.
Cor.-Bl. f. schweiz. Aertze, Jan. 25, 1913.

TUBERCULOSIS AND SYPHILIS

Hip Disease, Fixation in Treatment of.—E. H. Bradford.
Am. Jour. Orthop. Surg., February, 1913.

Roentgen-Ray Treatment of Tuberculous Focus. (Entgiftung des tuberkulosen Herdes durch Rontgenbestrahlung.)—H. Iselin. First part in No. 7; abstracted in preceding issue.
Deutsch. med. Wchnschr., Feb. 20, 1913.

Salvarsan and Neosalvarsan in Inherited Syphilis.—E. Dünzelmann.
Ztschr. f. Kinderh., January, 1913.

Syphilitic New-Born Infants, Sudden Death of. (Pathogénie de la mort "immediate" des nouveau-nés syphilitiques.)—A. Laborderie.
Rev. mens. de gynéc. d'obst. et de Péd., January, 1913.

Syphilitic Newly-Born Infants, Mechanism of the "Sudden" Death of. (Pathogénie de la mort subite des foetus syphilitiques.)—M. B. Laborderie.
Rev. prat. d'obst. et de gynéc., January, 1913.

Thyroidism and Tuberculosis. (Thyreose und Tuberkulose.)—L. Saathoff.
München. med. Wchnschr., Feb. 4, 1913.

Tubercle Bacilli in the Blood. (Auftreten virulenter Tuberkelbazillen im Blut nach der diagnostischen Tuberkulininjektion.)—Bacmeister. Zum Nachweis der "Tuberkelbazillen" im strömenden Blut.)—E. Kahn. (Tuberkelbazillennachweis im Blut.)—Kessler.
München. med. Wchnschr., Feb. 18, 1913.

Tuberculosis and Asthma in Children. (Rapport entre la tuberculose et l'asthme dans l'enfance.)—A. Rongel.
Arch de méd. des enfants, February, 1913.

Tuberculosis, Results in Hip after Mechanical Treatment (Without Traction).—H. L. Taylor.
Am. Jour. Orthop. Surg., February, 1913.

Tuberculosis in Infancy and Childhood, Diagnosis of.—C. H. Johnston.
Michigan State Med. Jour., February, 1913.

Tuberculosis of Child Kidney; Seven Cases. (Tuberculose rénale chez l'enfant. Cathétérisme à vision directe.)—H. L. Rocher and J. Ferron.
Jour. d'urologie, February, 1913.

Tuberculous Mediastinal Lymph-Nodes in Children, Symptoms of. (A tuberculose ganglionar mediastinica na infancia.)—J. M. Gesteira. Commenced in No. 2.
Brazil-med., Jan. 15, 1913.

Tuberculous Processes in Joints. (Gelenktuberkulose.)—L. W. Ely.
Arch. f. Gynäk., 1913, xcix, No. 1.

Tuberculous Puerperæ and Their Children, What Should Be Done With?—C. S. Bacon.
Illinois Med. Jour., February, 1913.

GASTROINTESTINAL SYSTEM

Abdominal Cases in Children, Treatment of.—P. L. Mummery.
Brit. Jour. Child. Dis., February, 1913.

Bile Passages, Congenital Dilatation of the. (Cholangiectasies congenitales.)—M. Letulle.
Presse méd., Feb. 1, 1913.

Digestive Disturbances, Research on the Pathogenesis of. VII. (Ueber die flüchtigen Fettsäuren im Mageninhalt magendarmkranker und uberfutterte Säuglinge.)—K. Huldschinsky.
Ztschr. f. Kinderh., January, 1913.

Dysentery, Flagellate, in Children.—Mello Leitas.
Brit. Jour. Dis. Child., February, 1913.

Gastro-Intestinal Canal, Newer Teachings of Diseases of.—M. I. Knapp.
New York Med. Jour., March 1, 1913.

Gastro-Intestinal Lesions, Value of Roentgen Ray in Diagnosis of.—H. J. Means.
Ohio State Med. Jour., Feb. 15, 1913.

Helminths, Reflex Phenomena from.—M. Condorelli.
Policlinico, Jan. 12, 1913.

Hernia in Children, Treatment of Inguinal.—J. D. Singley.
Pennsylvania Med. Jour., February, 1913.

Intestinal Dyspepsia in Children.—E. Cautley.
Med. Press and Circ., Feb. 19, 1913.

Intestine, Congenital Atresia of the. (Neuer Beitrag zur Pathogenese der angeborenen Darmatresien.)—H. Forssner.
Zentralbl. f. Chir., Feb. 8, 1913.

Pylorus, Stenosis of, in Infancy.—J. W. Keefe.
Am. Jour. Obst., February, 1913.

RESPIRATORY SYSTEM

Breathing and Abnormal Dental Malocclusion.—S. M. Weeks.
Arch. Pediat., January, 1913.

Lymph-Nodes at Bifurcation, Resection of, to Relieve Tracheal Stenosis.—P. M. R. Betke.
Berl. klin. Wchnschr., Jan. 27, 1913.

Tracheal Cough. (Ueber Trachealhusten.)—M. Buch.
St. Petersb. med. Wchnschr., Jan. 28, 1913.

CIRCULATORY SYSTEM

Anemia, Leishman, in a Child.—P. Mazzitelli.
Policlinico, Rome, Feb. 2, 1913.

Arterial Pressure in Children.—M. Leitao.
Arch. de méd. des enfants, February, 1913.

Eosinophilia in the Exudative Diathesis.—A. Benfey.
Monatschr. f. Kinderh., 1913, xi, No. 9.

Heart, Congenital Malformation of the. (Enfermedad de roger.)—P. J. Garcia.
Semana méd., Jan. 16, 1913.

NERVOUS SYSTEM

Feeble-Minded and Idiots, Mortality in Four Thousand.—L. P. Clark and W. L. Stowell.
New York Med. Jour., Feb. 22, 1913.

Mental Deficiency in Its Relation to Medical Profession, Problem of.—L. M. Halsey.
Jour. New Jersey Med. Soc., February, 1913.

Nervousness in Children: How to Prevent It.—T. A. Williams.
Arch. Pediat., January, 1913.

Pyramidal Paralysis. (Ekstrapyramidale motoriske affektioner.)—G. H. M. Krohn.
Norsk Mag. f. Laegevidensk, February, 1913.

School Child, Subnormal.—L. T. Royster.
Bull. Am. Acad. Med., February, 1913.

GENITO-URINARY SYSTEM

Albuminuria, Lordotic, Pathology of.—K. Dietl.
Wien. klin. Wchnschr., Feb. 13, 1913.

Hydrocele in Infants, Six Cases Treated by Operation.—J. H. Nicoll.
Brit. Med. Jour., Feb. 22, 1913.

Stone in Bladder in Children, Surgical Treatment of.—R. T. Ferguson.
Jour. S. Carolina Med. Assn., February, 1913.

OSSEOUS SYSTEM

Fibula, Two Cases of Congenital Absence of.—P. LeBreton.
Am. Jour. Orthop. Surg., February, 1913.

Patella, Familial Recurring Dislocation of the. (Un cas de luxation récidivante de la rotule.)—M. Wilbouchewitch.
Bull. Soc. de pediat., January, 1913.

EYE, EAR, NOSE AND THROAT

Choked Disk, Decompressive Measures with. (Druckentlastende Eingriffe bei Stauungspapille.)—R. Hessberg.
Med. Klin., Feb. 2, 1913.

Conjunctivitis, Follicular; Its Relation to Adenoids.—T. E. Oertel.
Jour. Med. Assn. of Georgia, February, 1913.

Deaf Child, Early Home Treatment of.—G. Hudson-Makuen.
Laryngoscope, February, 1913.

Deafness, Sporadic Congenital, and Deafness from Syphilis.—J. K. Love.
Glasgow Med. Jour., February, 1913.

Eyes of School Children, Protection of.—N. M. Black and F. A. Vaughn.
Ophth. Rec., February, 1913.

Gonorrheal Ophthalmia Treated with Gonococcus Vaccines.—W. K. Mittendorf.
Med. Rec., New York, March 8, 1913.

Hemorrhage, Fatal, from the Throat.—J. D. Rolleston.
Brit. Jour Child. Dis., February, 1913.

Keratitis, Interstitial.—F. A. Anderson.
Dublin Jour. Med. Sc., February, 1913.

Laryngoscopy, Tracheobronchoscopy and Esophagoscopy, Direct.—A. L. Turner and J. S. Fraser.
Edinburgh Med. Jour., February, 1913.

Middle Ear, Management of Acute and Chronic Suppuration of.—J. J. Pattee.
Colorado Med., February, 1913.

Nasal Accessory Sinuses in Children, Inflammatory Affections of.—S. Oppenheimer.
Arch. Pediat., January, 1913.

Ophthalmia Neonatorum: Administrative Standards.—H. C. Greene.
Boston Med. and Surg. Jour., Feb. 20, 1913.

Otitis Media and Method of Overcoming Difficulty, Inadequacy of Drainage Sometimes Obtained by Ordinary Myringotomy in Acute.—R. Lewis.
Laryngoscope, February, 1913.

Pseudo-Diphtheria Bacilli in Middle Ear Disease.—D'Espine.
Rev. Med. de la Suisse romande, Jan. 20, 1913.

Strabismus, Convergent, Experiences with Treatment of.—E. Lindgren.
Hospitalstid, Feb. 12, 1913.

Syphilitic Otitis Media.—C. Luders.
Deutsch. med. Wchnschr., Jan. 30, 1913.

Tonsillectomy, Technic for. (Die Tonsillenextirpation, ihre Gefahren und deren Bekampfung.)—M. Halle.
Deutsch. med. Wchnschr., Feb. 20, 1913.

Tonsillotomy and Tonsillectomy, Remote Results of.—H. Whale.
Lancet, London, Feb. 15, 1913.

Tonsils and Adenoids.—H. L. Scales.
Jour. Kansas Med. Soc., February, 1913.

Tonsils and Adenoids: Their Significance.—G. H. Kress.
California State Jour. Med., February, 1913.

Tonsils, Importance of Preserving Integrity of Contiguous Structures when Operating on.—C. M. Harris.
Jour. Med. Assn. of Georgia, February, 1913.

SURGERY AND ORTHOPEDICS

Bone Grafts. (Contributo sperimentale allo dell'infibulazione.)—L. G. Gazzotti.
Policlinico, Rome, January, 1913.

Club-Foot in Early Childhood, Treatment of.—A. S. B. Bankart.
Clin. Jour., London, Jan. 29, 1913.

Flat-Foot, Pathogenesis of Valgus. (Patogenesi del piede piatto valgo.)—C. Ghillini.
Policlinico, Rome, January, 1913.

Hip Disease, Mechanical Treatment of.—J. E. Goldthwait.
Am. Jour. Orthop. Surg., February, 1913.

Hip Dislocation by Anterior Incision, Open Reduction of Congenital.—K. Ludoff.
Am. Jour. Orthop. Surg., February, 1913.

Knee, Congenital Anterior Subluxation of.—L. Mayer.
Am. Jour. Orthop. Surg. February, 1913.

Orthodontia.—F. R. Stathers.
Arch. Pediat., February, 1913.

Orthopedic Gymnastic Exercises.—G. Staeubli. Commenced in No. 6.
Cor.-Bl. f. schweiz. Aertze, Jan. 25, 1913.

Scoliosis, Relation of, to School Seating.—J. W. Sever.
New York Med. Jour., Feb. 15, 1913.

THERAPEUTICS

Epilepsy, Genuine, The Pharmacologic Basis for Bromin Treatment in.—H. v. Wyss.
Deutsch. med. Wchnschr., Feb. 20, 1913.

Opiates in Childhood, Use of. (Ueber die Verwendung von Opiaten in Kindesalter.)—E. Döbeli.
Monatschr. f. Kinderh., 1913, xi, No. 9.

Phenolpthalein, a Dose of 1.8 gm. did not Hurt Child.—F. Orland.
Med. Klin., Feb. 16, 1913.

Serotherapy, Rectal, Inefficiency of. (Inefficacité de la sérothérapie par voie rectale.)—E. Lesné and L. Dreyfus.
Bull. de la Soc. de pediat., January, 1913.

MISCELLANEOUS

Alcoholism in Children Apparently Free from Morbid Heredity, Fourteen Cases of.—A. Gordon.
Med. Rec., New York, March 8, 1913.

Casein, Fever-Producing Property of. (Die pyretogenische Wirkung des Caseins aus Kuhmilch.—L. E. Holt and P. A. Levene.
Med. Klin., Feb. 16, 1913.

Dental Hygiene in School.—S. Falcão and Q. Graça.
Med. Contemp., Lisbon., Jan. 26, 1913.

Dental Prophylaxis.—P. B. McCullough.
Arch. Pediat., January, 1913.

Eugenics from Point of View of Ophthalmologist.—C. P. Franklin.
Jour. New Jersey Med. Soc., February, 1913.

Grave Danger from Sudden Change of Position in Febrile Diseases. (Peligro en las enfermedades febriles del paso brusco de la posicion horizontal a la vertical.)—S. Leduc.
Semana méd., Jan. 23, 1913.

Maternity Benefit Laws. (La roi le repos des femmes en couches au Sénat.)—L. Devraigne. (Le "Maternity Benefit" d'Angleterre. Ses conséquences sur l'enseignement et la pratique de l'obstétrique en Ecossa.)—M. Vaudescal.
Arch. mens. d'obst. et de Gynécol., January, 1913.

Medical School, Children's Hospital and the Public.—L. E. Holt.
Bull. Johns Hopkins Hosp., March, 1913.

Milk Supply of Springfield, Mass., Methods Employed and Results Obtained in Improving—J. A. Gamble.
Am. Jour. Pub. Health, January, 1913.

One Hundred Infants Followed from Birth to End of First Year.—C. Herrman.
Arch. Pediat., February, 1913.

Puberty, Premature. (Vorzeitige Menstruation, Geschlechtsreife und Entwicklung.)—J. Lenz.
Arch. f. Gynäk., Feb. 8, 1913.

Rachiocentesis, an Aid to Diagnosis. Its Value in Relieving Convulsions.—L. Fischer.
Arch. Pediat., February, 1913.

School Children, Colorado Method for Examination and Care of.—M. E. Bates.
Bull. Am. Acad. Med., February, 1913.

School for Cripples in Cleveland, Management, Maintenance and Efficiency of.—J. E. Tuckerman.
Bull. Am. Acad. Med., February, 1913.

Teething as Cause of Disease in Infancy.
New York Med. Jour., March 8, 1913.

Temperature of Children. (Normale Korpertemperatur der Kinder und ihr Verhalten bei Bewegung und Ruhe.)—D. Fraenkel.
Deutsch. med. Wchnschr., Feb. 6, 1913.

ENGLISH CONFERENCE ON INFANT MORTALITY

An English-speaking Conference on the Prevention of Infant Mortality will be held in Caxton Hall, Westminster, London, on Monday morning, Monday afternoon and Tuesday morning, Aug. 4 and 5, 1913. The meetings will be held under the auspices of the (British) National Association for the Prevention of Infant Mortality and The Welfare of Infancy under the patronage of the King and Queen, and will convene immediately preceding the opening of the International Medical Congress.

A tentative program has been issued by the committee which indicates that the papers will consist largely of medical opinion. The subjects treated will be:

The responsibility of central and local authorities in infant and child hygiene.

The administrative control of the milk-supply.

The necessity for special education in infant hygiene.

Medical problems in infant nutrition.

Antenatal hygiene.

The president of the conference will be the Hon. John Burns, M. P., president for the Local Government Board. The chairman of the English Executive Committee is Sir Thomas Barlow and the secretary, Miss J. Halford, 4 Tavistock Square, London, W. C.

The American committee, in charge of the part to be taken by the United States and Canada, will furnish information to those desiring to attend the conference.

Dr. Henry L. Coit, chairman, 277 Mt. Prospect Avenue, Newark, N. J.

Dr. Philip Van Ingen, secretary, 125 East Seventy-First Street, New York City.